Appendix 15
Stormwater Tree Cell Monitoring Plan

Tree Cell Effectiveness Evaluation Monitoring Plan

Prepared by

Ada County Highway District

Stormwater Quality

Garden City, ID

September 2015

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1. Introduction

1.1 Basis for Monitoring Plan

Ada County Highway District (ACHD) has been working in partnership with Capital City Development Corporation (CCDC) and the City of Boise through the development of the Downtown Boise Implementation Plan (DBIP) for transportation and streetscape improvements within Downtown Boise. The DBIP specifically recommends identifying opportunities for Low Impact Development (LID) in downtown projects with coordinating efforts between ACHD and CCDC (ACHD, 2013). CCDC has divided the downtown Boise area into urban renewal districts to focus revitalization projects into specific districts within the larger downtown Boise area. CCDC's mission to revitalize downtown Boise incorporates the goal of "improving quality of life in Downtown Boise" by way of ensuring "clean air and water" in the Westside Urban Renewal District, as outlined in the Westside Downtown Framework Master Plan (Boise City Council, 2001) A map of CCDC's urban renewal districts, including the Westside Urban Renewal District are shown in Appendix A.

Specifically, the Westside Downtown Framework Master Plan provides guidance to improve water efficiency by reducing and treating runoff, which coincides with ACHD's goals of reducing pollutants discharged from the Municipal Separate Storm Sewer System (MS4) to the maximum extent practicable to protect the water quality of the Boise River. In order to implement these goals, CCDC has initiated the 2015 Westside Downtown Streetscape Project. The project improvements include installing tree cell systems, some of which incorporate a stormwater management system, along multiple block faces in Downtown Boise. CCDC has chosen to use Silva Cell systems, by DeepRoot, for their tree cell installations.

> *"The Silva Cell is a modular suspended pavement system that uses soil volumes to support large tree growth and provide powerful on-site stormwater management through absorption, evapotranspiration and interception.*
> *– Deeproot (2015)*

A schematic displaying the Silva Cell system installed is shown in Appendix A. ACHD has selected one of these tree cell systems to evaluate its effectiveness as one of three Green Stormwater Infrastructure (GSI) pilot projects, required by ACHD's National Pollutant Discharge Elimination System (NPDES) Phase I Permit (IDS-027561). The NPDES Phase I Permit (Permit) is also issued to the City of Boise, Boise State University, Ada County Drainage District #3 and the Idaho Transportation Department, District 3. Collectively these entities along with ACHD are referred to as the "Permittees". The Permit was issued effective February 1, 2013, to the Permittees and requires the Permittees identify and construct three Low Impact Development (LID) or Green Stormwater Infrastructure (GSI) pilot projects. Section II.B.2.C.ii of the Permit outlines the following requirements for the performance evaluation of GSI techniques (Appendix B):

The Permittees must monitor, calculate or model changes in runoff quantities for each pilot project site in the following manner:

1. *For retrofit projects, calculate changes in runoff quantities as a percentage of 100% pervious surface before and after implementation of the LID practice;*
2. *Measure the runoff flow rate and prepare runoff hydrographs to characterize peak runoff rates and volumes, discharge rates and volumes, and duration of discharge volumes;*
3. *Quantification and description of each type of land cover contributing to surface runoff for each pilot project, including area, slope, vegetation type and condition for pervious surfaces, and the nature of impervious surfaces;*
4. *Use runoff values to evaluate the overall effectiveness of various technique(s) or practice(s) that address appropriate use, design, type, size, soil type and operation and maintenance practices.*

ACHD installed the first GSI pilot project in the summer of 2014, which consists of two alleys retrofitted with permeable pavers, also located in the Downtown Boise area. ACHD is monitoring the permeable paver alleys for effectiveness as a GSI practice. The City of Boise is planning on installing the third GSI pilot project as part of the new Bown Crossing Library located in southeast Boise.

GSI practices have been developed to reduce onsite runoff from reaching the stormwater conveyance system and thereby reduce pollutant loads associated with runoff. The goal of GSI is to closely mimic a site's predevelopment hydrology by using techniques which infiltrate, filter, store or detain stormwater rather than convey it offsite to receiving water bodies, such as the Boise River.

In addition to the Permit requirements, this monitoring plan is based on level of service goals and outcome levels identified in the Program Monitoring and Evaluation Plan (PMEP). The PMEP provides guidance to tie together all monitoring requirements under the Permit (i.e. stormwater outfall monitoring, dry weather outfall monitoring, structural control monitoring, and GSI monitoring (ACHD, 2013).

This plan focuses on monitoring the performance of the Silva cell systems installed on Main Street between 14th and 15th Streets in Downtown Boise. Precipitation volume and onsite conditions will be monitored at least until the project's final evaluation, due the 5th year of the Permit (December 2018). The performance monitoring approach described in this plan will provide the required information to complete the overall evaluation of this GSI technique. Results will be used to develop an incentive strategy for the increased use of tree cells as a GSI technique in both private and public sector development projects throughout the Permit area.

1.2 Monitoring Objectives

The Silva Cell system will be monitored to (1) determine the effectiveness of the systems in reducing runoff and thereby reducing pollutants discharging off site, (2) to evaluate performance relative to design parameters and (3) to understand the maintenance requirements of these systems.

The PMEP provides guidance for the evaluation and assessment of GSI projects and designates flow reduction as a surrogate for pollutant load reduction due to the difficulties of directly monitoring pollutants in stormwater infiltration treatment systems (PMEP 4.4.2), which can be found in Appendix B. The objectives of this plan are focused on understanding the hydrology of the sites before and after the installation of the Silva Cells through monitoring and quantifying the reductions in flow. The information collected under this plan will assist in determining if this project meets the Outcome Levels and ultimately the Level of Service priorities outlined in the PMEP for this GSI solution.

This plan is designed to direct data collection efforts to assist in meeting the Permit requirements and in addressing the PMEP assessment and evaluation guidance. The Tree Cell Effectiveness Evaluation Monitoring Plan (TCEEMP) outlines specific modeling, data collection and analysis to meet the following plan objectives:

1. Estimate changes in runoff quantities and flow rates
2. Develop site hydrographs
3. Compare pre and post-construction site hydrological conditions
4. Assess performance and maintenance effectiveness
5. Collect physical data to validate modeled results and observational data

1.3 Task Organization

The Permit requirement for evaluation and assessment of (3) GSI pilot projects is a joint Permittee responsibility. ACHD is the lead agency for monitoring activities under the Permit. ACHD stormwater staff will be responsible for data collection, management and reporting as specified in this plan.

2. Project Details

The Silva Cells under investigation are part of the 2015 Westside Downtown Streetscape project that is being implemented by CCDC (CCDC, 2015). This project includes updating 4.5 block faces with improvements including but not limited to new curb and gutter, street trees and grates, historic street lighting, pedestrian ramps and Silva Cell and stormwater management systems. Three block faces will include a stormwater management component in the Silva Cell design.

2.1 Silva Cell System Description

The installation of Silva Cells involves removal of any existing paving, excavation and compaction of the sub base, installation of geotextile fabric and aggregate over the compacted sub base, installation and anchoring of the Silva Cells, wrapping the Silva Cells in geogrid, filling the empty cells with Bioretention Soil Mix (BSM), backfilling around the perimeter of the cells, installing geotextile fabric over the top of the Silva cell decks, and compacting aggregate over the top of the geotextile. Root barrier is installed around the perimeter of the tree opening to protect the paving layer and to redirect tree roots into the Silva Cell system. Silva Cells are an interlocking system of two main components: frames and decks. One cell consists of a frame and one deck, which put together are 48” wide, 24” deep and 126” tall. They can be stacked in layers of one, two or three deep. The monitored system contains frames stacked two deep. A 6” pipe connected to a catch basin under a drop inlet in the gutter directs stormflow into a 6” perforated pipe which runs the length of the Silva Cell system, installed immediately under the decking, surrounded by aggregate drain rock around the pipe. A clean-out is installed at the junction of the catch basin inflow pipe and the perforated pipe. A observation well is also installed near the Silva cell system to the depth of the bottom of the Silva cell frame. Strata, a geotechnical testing company, tested the underlying soils at three locations, one at the west end, one at the east end and one centrally located near a light pole, on the site. The two tests performed at the east and west ends of the site found clayey sand to sandy clay soils which infiltrated 3 inches per hour. The third central location found sandy silt to silty sand soils which infiltrated 4 inches per hour.

Details of the infiltration testing can be found in Appendix C. Any incoming runoff that exceeds the infiltration rate of this system will bypass the drop inlet and continue to flow to the next drop inlet in the existing storm water conveyance system. Stormwater runoff currently discharges to the Boise River at this location.

Each Silva cell is designed to hold approximately 10 cubic feet of soil with 20% void space, which contains 2 cubic feet of runoff. Under most storm conditions, stormwater is expected to be retained on site. Water draining into the gutters of the stormwater conveyance system, which is directed into the Silva cells, includes direct rainfall and runoff from adjacent parking lots, roof drains and roadways, as explained in the Site Description section below. The GSI evaluation will be considering the appropriateness of the sizing based on the hydrologic performance data collected according to this monitoring plan.

There are two adjacent Silva Cell systems being monitored: the east basin contains 100 cells and the west basin contains 102 cells. The stormwater conveyance system directs storm flow west down Main Street's south gutter. Each system has a drop inlet which serves as the system's inlet and outlet. If the east basin Silva cell system's storage is exceeded, stormwater will flow into the west basin's drop inlet. If the west basin's storage is exceeded, stormwater will continue to flow down the gutters of the conveyance system into the next drop inlet, which directs stormwater into pipes of the conveyance system. Appendix D includes the project plan set.

2.2 Site Descriptions

The following site descriptions and associated maps provide the required information outlined in Permit Section II.B.2.c.ii, including land cover, area, slope, pervious area description and impervious area descriptions, as well as geotechnical study results. Photographs of the project sites before and after construction, as well as detailed maps of the project location are included in Appendix A. Subgrade observation and infiltration testing results completed by Strata are included in Appendix C.

***Location*:** east half of block on the south side of Main St. between 14th Street and 15th Street, Boise, Idaho
***Land cover*:** asphalt road surface and concrete
***Total drainage area*:** 7,634sq. ft.
East Basin: 4,855 sq.ft.
West Basin: 2,779 sq.ft.

Silva Cell Capacity (Type 1 Cells)
East Basin:
Soil: 100 cells x 9.89 cubic feet/cell = 989 cu.ft.

Runoff: 100 cells x 1.98 cu. ft. runoff/cell + 10 cu.ft. perf. pipe= 207.8 cu.ft.

West Basin:

Soil:102 cells x 9.89 cubic feet/cell = 1,008.8 cu.ft.

Runoff:102 cells x 1.98 cu.ft. runoff/cell + 25 cu.ft. perf. Pipe = 227 cu.ft.

***Area description*:** 98% impervious

Slope: 0.01

***Underlying soils*:**

Test Location- East and West End: Clayey Sand/Sandy Clay

Percolation rate of underlying soil: 3 inches per hour (measured)

Test Location- Central under light pole: Silty Sand/Sandy Silt

Percolation rate of underlying soil: 4 inches per hour (measured)

***Safety Factor*:** 2.0

***Design Infiltration Rate*:** 2.0 inches per hour

2.3 Site Selection

Silva Cell installations considered for monitoring efforts only included those which were designed to receive stormwater inflow. The site selection assessment which outlines the advantages and disadvantages of each Silva cell location is included in Appendix E. In accordance with guidance provided in the PMEP, the monitored Silva cell site was chosen because it is within the Americana subwatershed, has safe access, was cost-efficient to monitor, and would provide the most accurate modeling results due to site design. This subwatershed is one of five monitored subwatersheds, as outlined in section IV of the Permit. It is also one of two planning areas that are being developed as part of Section II.A.4 of the Permit. The information gained from this project will help inform the pollution reduction strategies being developed for the Permit.

3. Monitoring and Data Collection

Data collection will involve compiling information from three sources: hydrological modeling, on-site observations, and physical data collection. Modeled results will be assessed against observations and physical site data as this information is collected over time. The data collected will be used for the overall evaluation of using Silva Cells as a GSI practice, to refine design specifications for future Silva cell projects and to assist in developing appropriate incentive strategies for promoting green stormwater infrastructure.

3.1 Hydrologic Modeling

HydroCAD is a computer aided design tool used to model stormwater runoff. HydroCAD provides flexibility in runoff calculations and system design and produces all data required by the permit including flow rates, runoff hydrographs, discharge rates, volumes and durations. Since inflow measurement is inherently difficult in urban environments and because GSI designs seek to infiltrate flow rather than concentrate it, modeling flows is an alternative to measuring inflow to the GSI. The hydrologic modeling will involve running various storm scenarios using HydroCAD,to characterize the site. As part of ACHD policy manual revisions, a new intensity-duration-frequency (IDF) curve was adopted for Ada County which includes 43 additional years of precipitation data. Model inputs include local rainfall data, which was entered in the form of ACHD's newly adopted intensity-duration-frequency (IDF) curve. This model synthetically generates rainfall distributions to calculate runoff using the Soil Conservation Service's (SCS) TR-20 runoff calculation method, which will estimate runoff quantities and runoff flow rates and allow for the development of hydrographs characterizing the hydrologic performance of the sites before and after the implementation of the GSI project. Details and assumptions of how the model characterizes the monitored Silva Cell sites are located in Appendix F. Initial model results are located in Appendix H.

3.2 On-site Observations

On-site observations will be made by ACHD stormwater staff to maintain a record of site conditions and to provide comparisons with the modeled results. Observations will occur prior to construction, during construction and post-construction. The types of observations will vary depending upon the activities occurring at the sites during the different project phases. Photographs will be taken during all phases providing visual records over time of the site conditions. The level and frequency of photo-documentation may be adjusted as data is gathered and comparisons with modeled results are made.

Stormwater staff will conduct field observations and photo documentation during and after rain events greater than 0.20 inches to record pre-construction, construction and post- construction conditions. The frequency of observation will depend upon when the rain event occurs (i.e. timing of storm or staff constraints due to other monitoring projects during storm events). To the extent possible, observations will occur as soon as practicable after an observable rain event occurs and follow-up field observations will be conducted, if needed, at 6 to 12 hour intervals-for up to 2 days post storm. Based on results from HydroCAD, ponding is not expected to occur with events producing as little as 0.20 inches, however, as a conservative estimate, observations will be conducted until it can be visually verified that no ponding or runoff occur during such

events. The observation schedule and storm conditions requiring observation may be adapted as data is collected.

Data collection sheets have been developed for each phase of the project. A Silva Cell Observation Form, Form GSI-2 (Appendix G) will be completed during each visit to standardize the documentation of the site conditions. All observation forms will be scanned, saved and stored on an ACHD server, which is backed up daily. A table summarizing each field visit will be maintained by ACHD staff. The observation form may be revised to include new information depending upon the phase of the project (i.e. pre-construction phase, construction phase, post-construction phase).

Pre-construction phase observations will include the presence of ponding water, run-off to the storm drain system, contaminants (e.g. sediment, oil sheen), flow from roof drain and any other notable occurrences. All observations will be recorded on Form GSI-2.

During the **construction phase** of the project all of the observations noted during the pre-construction phase will be recorded, as well as taking notes on subsurface conditions, construction installation, protection of infiltration medium and construction materials, mud tracking and stormwater run-on, and utility conflicts. All observations will be recorded on Form GSI-2.

Post-construction phase observations will include all of the observations noted during pre-construction phase, as well as the overall condition of site, observation well levels, performance following snow events, and evidence of maintenance activities.

3.3 Physical Data

Physical data will include precipitation measurements in the general vicinity of the project, water level measurements in the observation wells and video of the west basin's drop inlet. Physical data will be compared to observational data and modeled results. All collected data will be used to evaluate if maintenance is recommended to maintain system performance.

Precipitation data will be collected from the National Weather Service (NWS) Boise airport station website at http://www.nws.noaa.gov/climate/index.php?wfo=boi and from the ACHD Front rain gauge installed at Front St. and 17th St, Boise, Idaho. The ACHD rain gauge utilizes primary and backup HOBO data loggers that record events from a tipping-bucket style rain gauge that measures tips in 1/100 inch increments. The Front rain gauge is approximately 1,400 feet from the monitored Silva Cells, as shown in the map displayed in Appendix A . The rain gauge at Front St. will be downloaded periodically in accordance with Stormwater SOP 211a

(ACHD, 2014). Rain gauge data will be exported to an Excel spreadsheet where it will be compared with NWS data. Rain data will be analyzed over time to ensure that the rainfall distribution assumptions used in HydroCAD are reasonable.

Water levels in the observation wells will be observed and measured post storms, during on-site observations. An observation well was installed inside both the east (OW #2) and west basin (OW #1) Silva Cell systems. There was an additional well installed outside of the Silva Cell system as a reference (OW #3). The data will be used to analyze how quickly water infiltrates in the system in comparison to the volume of runoff calculated to enter the system, based on the size of the storm event. Presence or absence of overflow will be verified by video of the west basin's drop inlet. Verification of overflow, resulting in bypass continuing down the surface conveyance system, will be assumed to indicate the rate of runoff being directed into the system is larger than the infiltration rate of the underlying soil and the storage volume of the Silva Cell system was exceeded. Both observation wells and video of the drop inlet will be used to compare the actual performance of the Silva Cell system to the modeled performance.

4. Quality Assurance/Quality Control

All data collected as part of this project will be reviewed by the Stormwater Program Coordinator for accuracy and completeness. The Quality Assurance Program Plan (QAPP) guides all monitoring activities required by the Permit, including this monitoring plan (ACHD, 2014). The QAPP outlines the data quality objective (DQO) that has been developed for all monitoring plans. Section 1.8 of the QAPP summarizes the DQO for ACHD stormwater monitoring:

"Monitoring efforts will provide data of sufficient quality and quantity in accordance with permit requirements to accurately estimate pollutant concentrations and loading trends, evaluate effectiveness of permanent stormwater controls and GSI/LID projects, and support watershed and land use management initiatives."

The QAPP also describes data quality indicators (DQIs) which set measurable quantitative and qualitative goals for acceptable data to achieve the DQO described above. The following is an outline of the DQIs described in Section 8 of the QAPP: Project Required Detection Limits, Accuracy, Precision, Bias, Representativeness, Comparability, Completeness and Sufficiency. Modeling results will be compared to other simple models to ensure the DQIs are also followed.

5. Data Management and Reporting

All data collected as part of this plan will be stored in electronic format for secure storage and timely and accurate retrieval. The data, located on the S: drive in folder *STORMWATER>Phase 1 Monitoring>LID Monitoring* will be housed on an ACHD server which is backed-up nightly .

5.1 Data Collection Schedule

Data collection efforts began in March 2015 with the Silva Cell site evaluation. Construction occurred from October 5th to 23rd , 2015. A summary of the data collected and a short project status will be included as an appendix in each annual report. Data will be collected at least through the completion of the final pilot project evaluation report due with the 5th Year Annual Report (December 2018). Depending upon the results of the evaluation report, additional data may be collected.

5.1.1 Hydrologic Model Data

Hydrologic modeling data will be collected on an ongoing basis with model inputs and design being refined as more information is collected on actual site conditions and system performance. The sites will be modelled using the following scenarios:

- Pre-construction (existing) conditions
- Post-construction conditions
- Pre-development conditions (100% pervious)
- Individual Storm Events

The following outputs will be compared from each model scenario:

- runoff quantities
- runoff flow rates
- site hydrographs

Initial model results indicate that the Silva Cells will keep and manage onsite the runoff generated from the first 0.6 inches of rainfall, as required by the Permit in Section II.B.2.a (Appendix B). Initial results also indicate that the infiltration rate of the sub-base will be exceeded and ponding will begin to occur within the east basin during a 5 year event of 1.6 inches. The east basin will fill and bypass to the west basin will occur with a 25 year event of 2.2 inches. The west basin is expected to fill up and bypass to the gutter with a 100 year event of 2.8 inches. Therefore, the model estimates that the combination of both basins in the monitored Silva

Cell system will retain runoff onsite for most storm events, except large record events. Model results are based on 24 hour storm events. Initial model results are located in Appendix H. Model results for observed storm events will be included in the 4th Year Annual Report. Final model results will be included in the final pilot project evaluation.

5.1.2 Observational Data

As observational data is collected the results will be included in each annual report. This data will include all completed Observation Forms and the summary data table. All observational data will be included as part of the final pilot project evaluation.

5.1.3 Physical Data

Rainfall data, observation well level data, and video verification will be included in a summary table in each annual report. An analysis of this data will be included in the final pilot project evaluation.

5.2 Evaluation

The monitoring data gained from the TCEEMP will be used in the effectiveness evaluation as required by the Permit (Sections II.B.2.c.ii and IV.A.10), which are included in Appendix B. The evaluation will be guided by the PMEP and discuss Outcome Levels 4 and 5: Reducing Loads from Sources and Improving Runoff Quality, as described in the PMEP.

The evaluation will include a discussion of several objectives of the GSI pilot projects including: how the monitoring data will be used to evaluate the effectiveness of the GSI; how pollutant load reductions will be estimated from runoff reductions; cost-benefit analysis, short-term versus long-term performance; maintenance considerations; design sizing; construction logistics; future recommendations; and the development of a GSI incentive strategy (Permit *Section II.B.2.c*).

References

Ada County Highway District (ACHD). Downtown Boise Implementation Plan (DBIP). Available at: http://www.achdidaho.org/projects/Media/248/1960_13091ReportFINAL.pdf. 2013.

Stormwater Program Monitoring and Evaluation Plan (PMEP), 2013.

SOP 211a. Rain Gauge Data Download Using BoxCar Software. 2013

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Capital City Development Corporation. 2015 Streetscapes Westside Downtown. Available at: http://www.ccdcboise.com/ccdc-projects/streetscapes-2015-westside-downtown/. 2015.

Urban Renewal Districts. Available at: http://www.ccdcboise.com/development/urban-renewal-districts/. 2015.

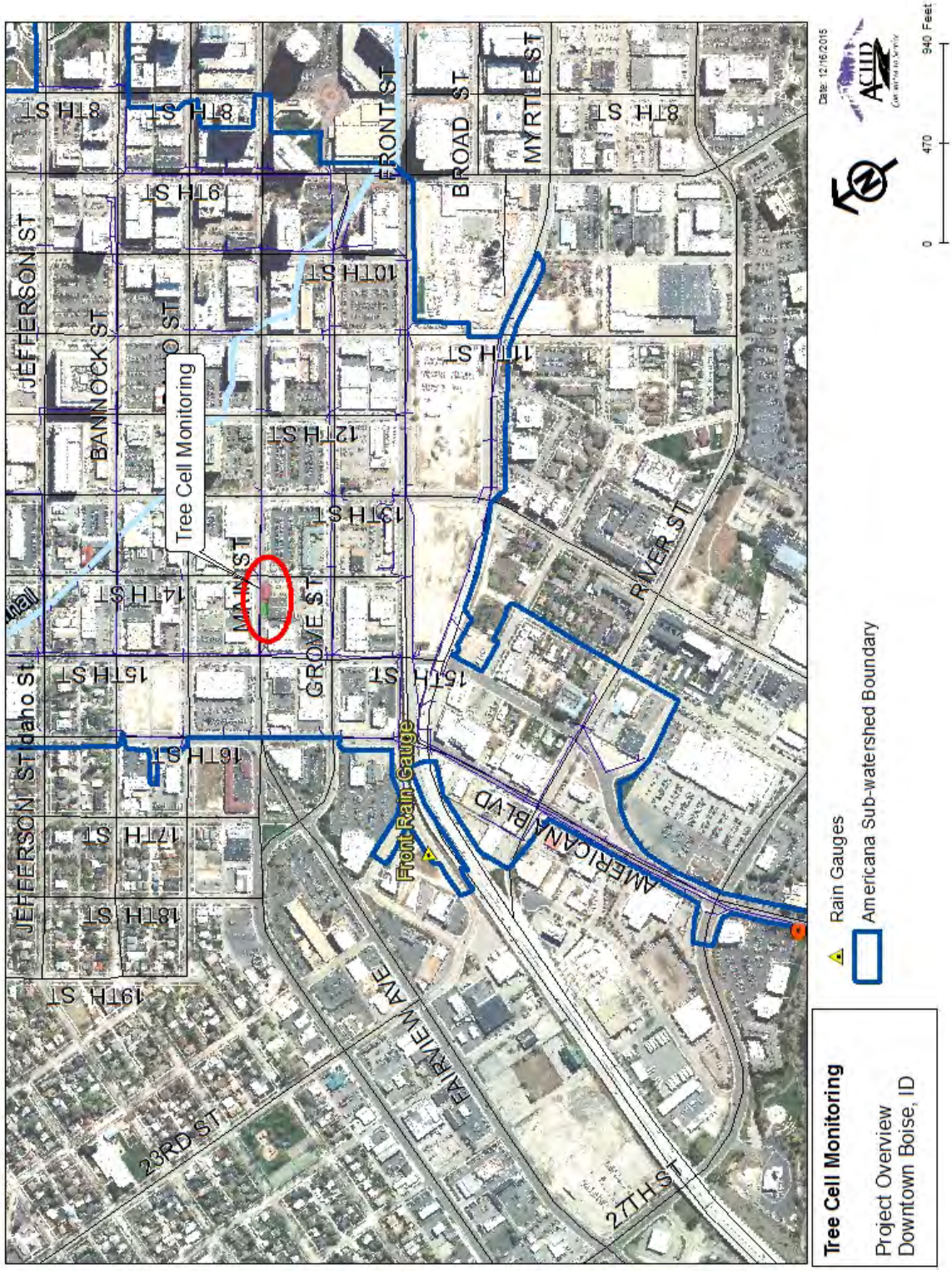
DeepRoot, Silva Cell. Available at: http://www.deeproot.com/. 2015.

Appendix A: Maps, Schematics & Photographs

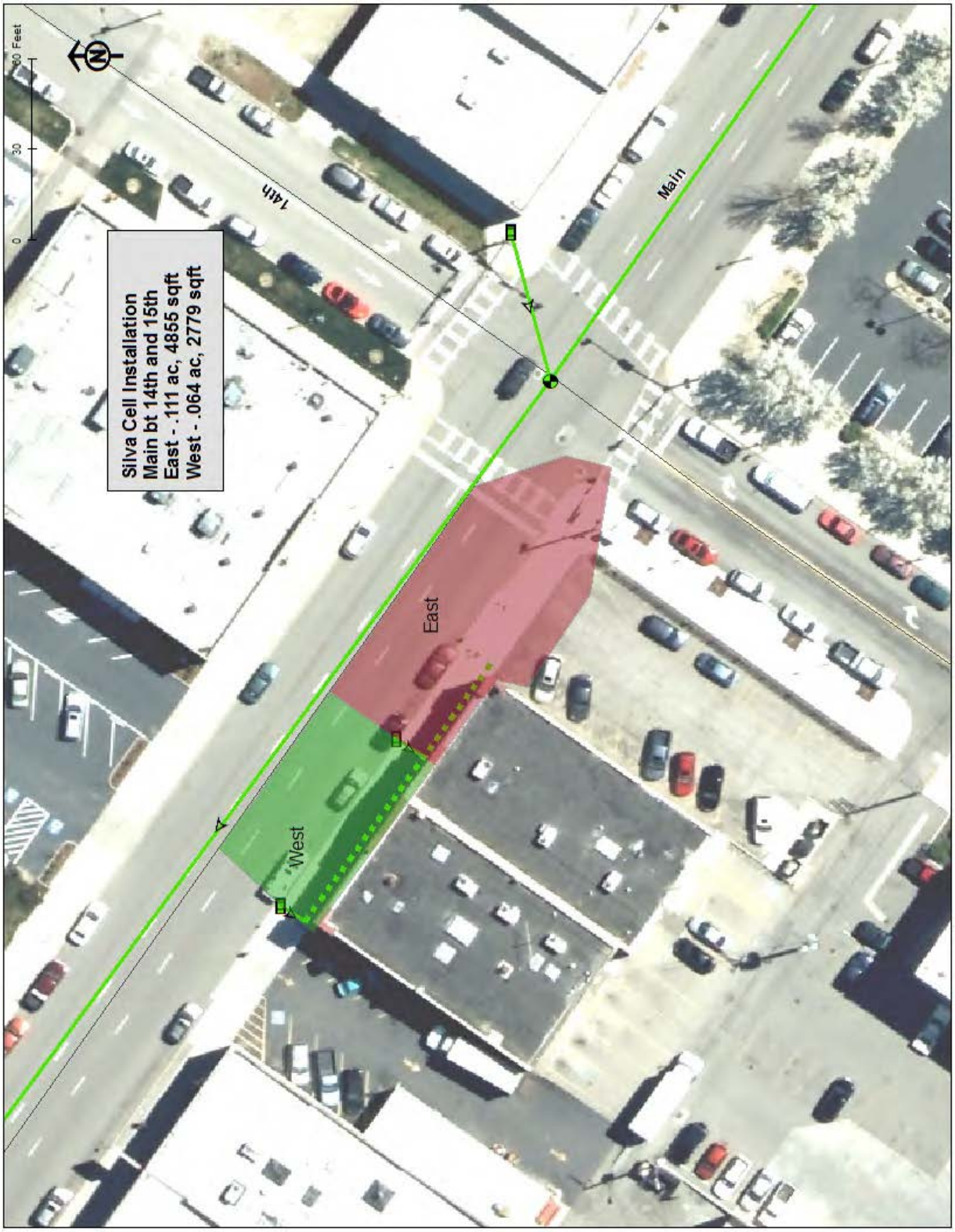
Map of CCDC Districts in Downtown Boise:



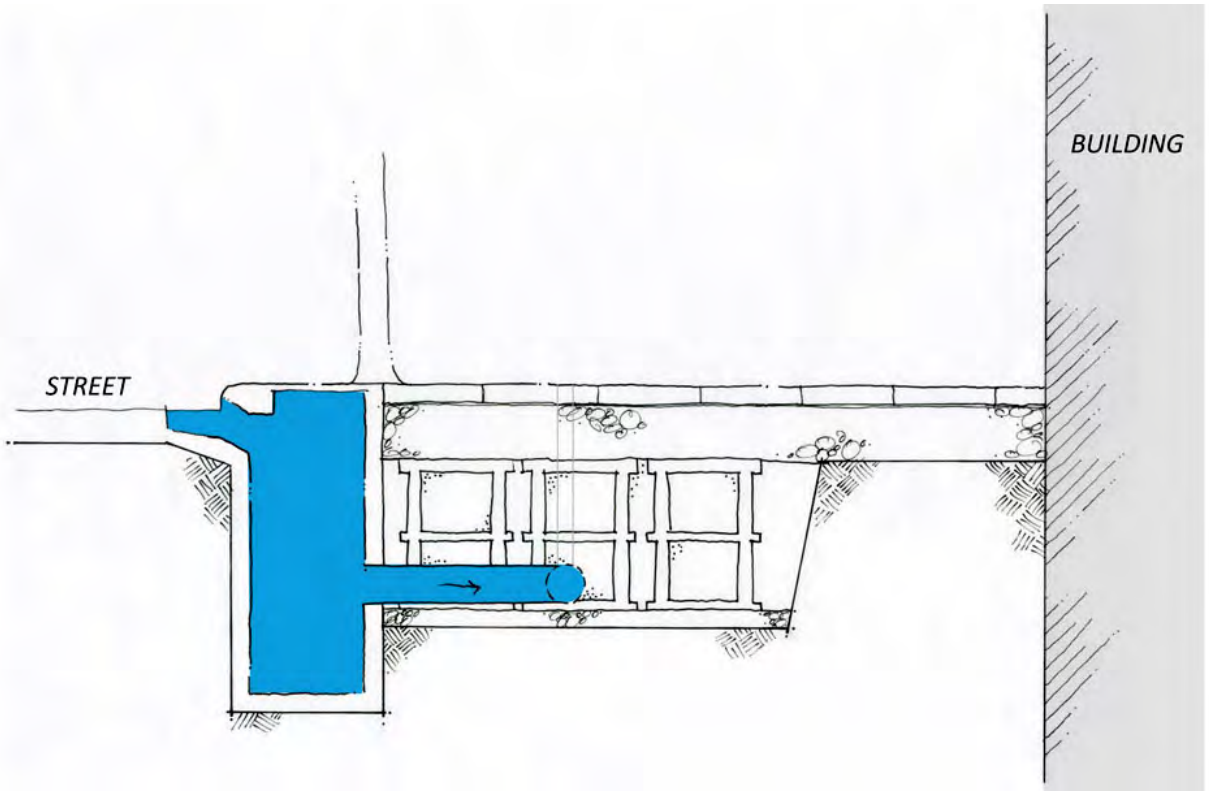
Map of Silva Cell Project Area and Rain Gauge:

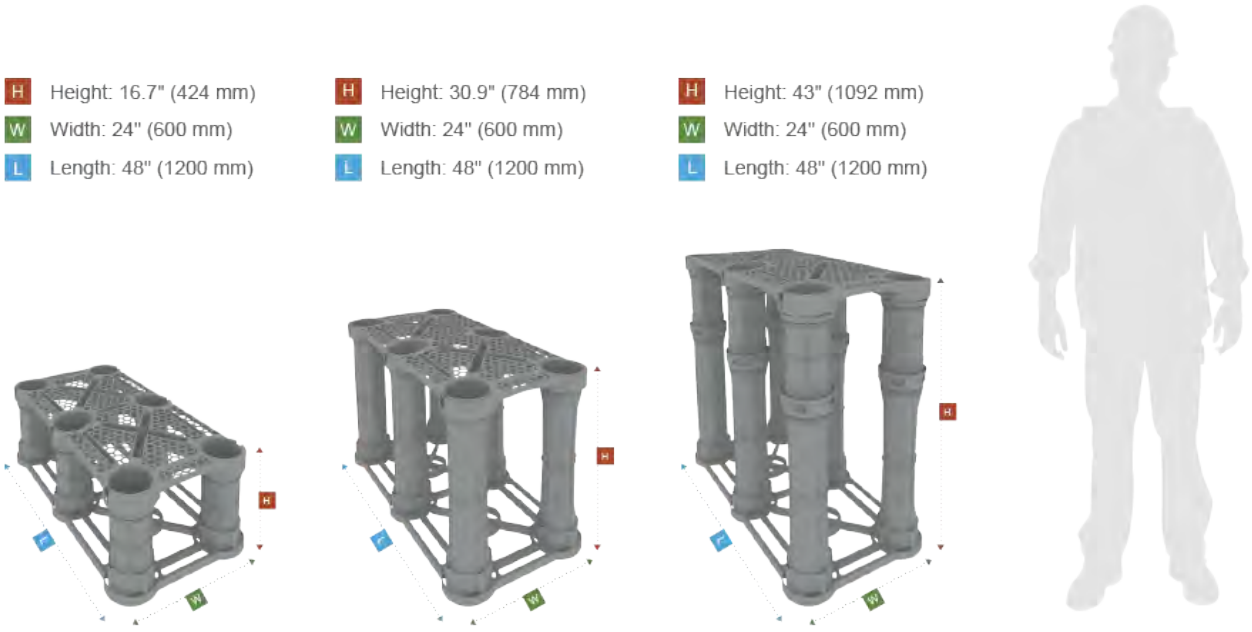


Map of Silva Cell Monitoring Site with Drainage Areas:



Schematics of Silva Cell System:





DeepRoot, 2015.

Pre-Construction Photos

9/22/15



Petso Building – photo taken on north side of Main Street facing southeast



Petso Building – photo taken on north side of Main Street facing south west on northwest corner of 14th and Main Streets

10/1/15



Petso Building – photo taken on south side of Main Street facing west on southwest corner of 14th and Main Streets

Construction Photos

10/5/15





Excavation

10/6/15



Infiltration Testing



10/6/15 continued



West End Test Location

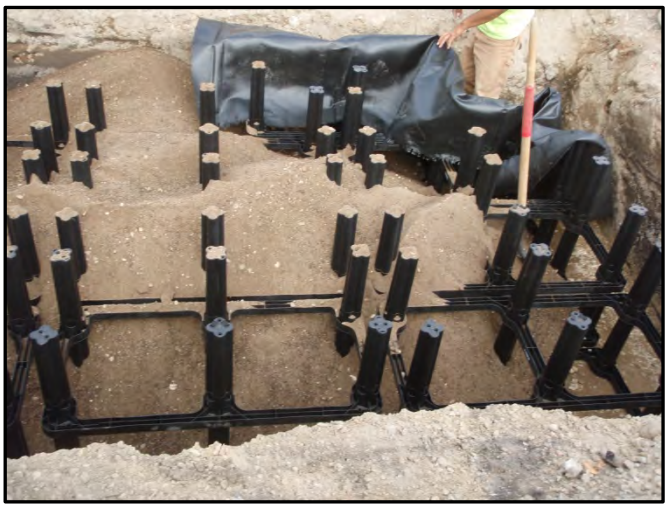


East End Test Location



Central Test Location

10/7/15



Installation of Silva Cells





10/8/15



Filling Silva Cells with Bioretention Soil Mix



10/9/15



Installing geotextile fabric and geogrid around Silva Cells



10/15/15





Laying concrete over Silva Cells for sidewalk

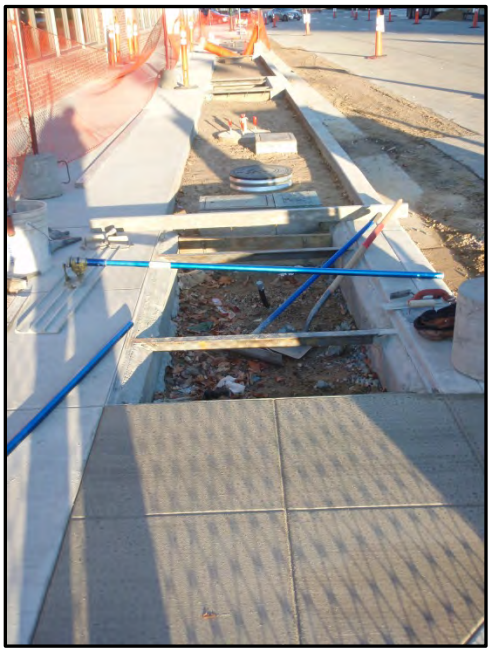
10/19/15

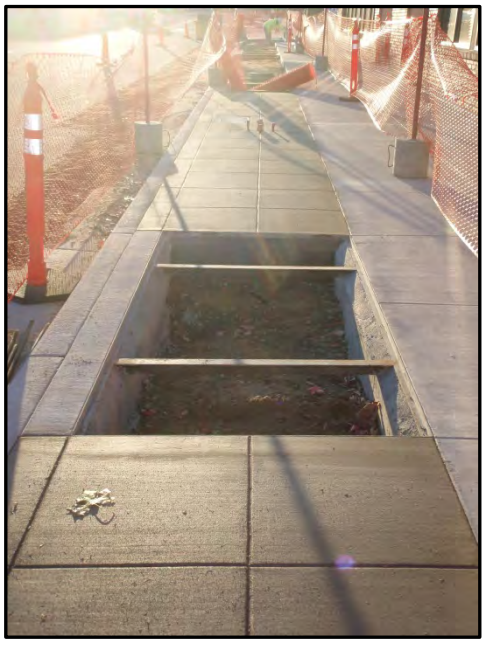


Preparation for laying concrete between Silva Cells



10/21/15





Empty tree wells with laid concrete curing

10/22/15



Filling tree wells with planting media



10/22/15 continued



Drop Inlet Video Camera Location

Southwest corner of Main and 14th Streets

Appendix B: NPDES Permit and PMEP excerpts

Boise/Garden City Area MS4, Permit No.: IDS-027561

Excerpt: Section II.B.2.c

c) **Green Infrastructure/Low Impact Development (LID) Incentive Strategy and Pilot Projects**. No later than September 30, 2015, the Permittees must develop a strategy to provide incentives for the increased use of LID techniques in private and public sector development projects within each Permittee's jurisdiction. Permittees must comply with applicable State and local public notice requirements when developing this Strategy. Pursuant to Part IV.A.2.a, the Strategy must reference methods of evaluating at least three (3) Green Infrastructure/LID pilot projects as described below. Permittees must implement the Green Infrastructure/LID Incentive Strategy, and complete an effectiveness evaluation of at least three pilot projects, prior to the expiration date of this Permit.

(i) As part of the 3rd Year Annual Report, the Permittees must submit the written Green Infrastructure /LID Incentive Strategy; the Strategy must include a description of at least three selected pilot projects, and a narrative report on the progress to evaluate the effectiveness of each selected LID technique or practice included in the pilot project. Each pilot project must include an evaluation of the effectiveness of LID technique(s) or practice(s) used for on-site control of water quality and/or quantity. Each Pilot Project must involve at least one or more of the following characteristics:

-The project manages runoff from at least 3,000 square feet of impervious surface;

-The project involves transportation related location(s) (including parking lots);

-The drainage area of the project is greater than five acres in size; and/or

-The project involves mitigation of existing storm water discharges to one or more of the water bodies listed in Table II.C.

(ii) Consistent with Part IV.A.10, the Permittees must evaluate the performance of LID technique(s) or practice(s) in each pilot project, and include a progress report on overall strategy implementation in the 4th Annual Report. Final pilot project evaluations must be submitted in the 5th Year Annual Report. The Permittees must monitor, calculate or model changes in runoff quantities for each of the pilot project sites in the following manner:

- For retrofit projects, changes in runoff quantities shall be calculated as a percentage of 100% pervious surface before and after implementation of the LID technique(s) or practice(s).
- For new construction projects, changes in runoff quantities shall be calculated for development scenarios both with LID technique(s) or practice(s) and without LID technique(s) or practice(s).

- The Permittees must measure runoff flow rate and subsequently prepare runoff hydrographs to characterize peak runoff rates and volumes, discharge rates and volumes, and duration of discharge volumes. The evaluation must include quantification and description of each type of land cover contributing to surface

runoff for each pilot project, including area, slope, vegetation type and condition for pervious surfaces, and the nature of impervious surfaces.

- The Permittees must use these runoff values to evaluate the overall effectiveness of various LID technique(s) or practice(s) and to develop recommendations for future adoption of LID technique(s) or practice(s) that address appropriate use, design, type, size, soil type and operation and maintenance practices.

(iii) **Riparian Zone Management and Outfall Disconnection.** No later than September 30, 2015, the Permittees must identify and prioritize riparian areas appropriate for Permittee acquisition and protection. Prior to the expiration date of this Permit, the Permittees must undertake and complete at least one project designed to reduce the flow of untreated urban storm water discharging through the MS4 system through the use of vegetated swales, storm water treatment wetlands and/or other appropriate techniques. The Permittees must submit the list of prioritized riparian protection areas, and a status report on the planning and implementation of the outfall disconnection project, as part of the 3rd Year Annual Report. Documentation of the completed outfall disconnection project must be included in the 5th Year Annual Report.

(iv) **Repair of Public Streets, Roads and Parking Lots.** When public streets, roads or parking lots are repaired (as defined in Part VII), the Permittees performing these repairs must evaluate the feasibility of incorporating runoff reduction techniques into the repair by using canopy interception, bioretention, soil amendments, evaporation, rainfall harvesting, engineered infiltration, rain gardens, infiltration trenches, extended filtration and/or evapotranspiration and/or any combination of the aforementioned practices. Where such practices are found to be technically feasible, the Permittee performing the repair must use such practices in the design and repair. These requirements apply only to projects whose design process is started after the effective date of this Permit. As part of the 5th Year Annual Report, the Permittees must list the locations of street, road and parking lot repair work completed since the effective date of the Permit that have incorporated such runoff reduction practices, and the receiving water body(s) benefitting from such practices. This documentation must include a general description of the project design, estimated total cost, and estimates of total flow volume and pollutant reduction achieved compared to traditional design practices.

Excerpt: Section IV.A.10

10. Evaluate the Effectiveness of Green Infrastructure/Low Impact Development Pilot Projects. The Permittees must evaluate the performance and effectiveness of the three pilot projects required in Part II.B.2.c of this Permit, or contract with another entity to conduct such evaluations. An evaluation summary of the LID technique or control and any recommendations of improved treatment performance must be submitted in subsequent Annual Reports as the evaluation projects are implemented and completed.

Excerpt: Section II.B.2.a.i

(i) The ordinance/regulatory mechanism must include site design standards for all new and redevelopment that require, in combination or alone, storm water management measures that keep and manage onsite the runoff generated from the first 0.6 inches of rainfall from a 24-hour event preceded by 48 hours of no measurable precipitation. Runoff volume reduction can be achieved by canopy interception, soil amendments, biorentention, evapotranspiration, rainfall harvesting, engineered infiltration, extended filtration, and/or any combination of such practices that will capture the first 0.6 inches of rainfall. An Underground Injection Control permit may be required when certain conditions are met. The ordinance or regulatory mechanism must require that the first 0.6 inches of rainfall be 100% managed with no discharge to surface waters, except when the Permitteechooses to implement the conditions of II.B.2.a.ii below.

Program Monitoring and Evaluation Plan
Excerpt Section 4.4

4.4 LID Evaluation and Assessment Monitoring

The Permittees are required to evaluate the effectiveness of Green Infrastructure/Low Impact Development (GI/LID) Pilot projects. LID solutions mimic natural hydrology to reduce pollutant loads.

These solutions are localized and assist in the efforts of reducing flow conveyed through the MS4.

4.4.1 Permit Requirements

Under this Section (Section II.B.2.c) of the Permit the Permittees are required to establish a GI/LID incentive strategy.

4.4.2 Evaluation and Assessment

In order to relate the assessment and evaluation of GI/LID solutions pollutant load reductions must be characterized. Therefore, evaluation of this solution must measure or estimate both flow and concentration into and out of the stormwater control. Since LID relies heavily on infiltration to treat stormwater, outfall monitoring may be difficult. In these situations the evaluation can assume that flow reduction is a surrogate for pollutant load reduction. If at some point in the program enough data has been collected to normalize reduction expectations for these solutions a modeling approach can be used to assess the pollutant reduction capacity of GI/LID solutions.

Appendix C: Subgrade Observation and Infiltration Testing

STRATA
A PROFESSIONAL SERVICES CORPORATION
Integrity from the Ground Up

October 14, 2015
File: BO15322A

Mr. Ricardo Zavala, P.E.
Quadrant Consulting, Inc.
1904 West Overland Road
Boise, Idaho 83705

RE: **Subgrade Observation and Infiltration Testing**
Westside Streetscapes Main & 15th Street
Boise, Idaho

Dear Ricardo:

Strata, A Professional Services Corporation (STRATA) preformed infiltration testing for the Silva Cell located on Main Street east of 15th Street in Boise, Idaho. On Tuesday October 6, 2015, STRATA made a site visit to observe the subgrade conditions at the Silva Cell location near the address of 1409 Main Street. The subgrade was excavated to a depth of approximately 4 feet below the sidewalk grade, and consisted of stiff to very stiff clayey sand or sandy clay. We met with Monica Low from ACHD, yourself and Rob Clonninger with Guho construction to discuss the infiltration testing requirements. STRATA hand excavated 2 holes at the east and west ends of the planned Silva Cells, to a depth of approximately 9 inches below the subgrade. The soil exposed in the holes was consistent with the clayey sand/sandy clay observed at subgrade. STRATA advanced an additional hand excavated test pit from a depth of approximately 5.5 feet below sidewalk grade at the west light pole foundation location. At this location we encountered sandy silt to silty sand at subgrade elevation. It was decided to initiate infiltration testing at each of the 3 locations by presoaking and saturating the subgrade soils at the test locations. STRATA proceeded to pour water into each of these test hole locations in the morning and again in the evening of October 6, 2015.

We returned to the site on Wednesday October 7, 2015 to perform infiltration tests at each of the 3 test locations as described above. Water was placed into each of the holes to a depth of approximately 9 inches and the rate of infiltration was measured in approximately 10 minute increments for a period of 1 hour at each location. The infiltration test results showed that a measured infiltration rate of 3 inches per hour was observed in the east and west test pits excavated into the clayey sand subgrade. A measured infiltration rate of 4 inches per hour was observed in the sandy silt/silty sand at a depth of approximately 5 ½ feet below the sidewalk level at the west light pole foundation.

The above infiltration rates were field measured tests observed by STRATA. We recommend you consider a safety factor in the range of 1.5 to 2.0 to establish design infiltration rates based on the potential for siltation during the life of the drainage structure. Additionally, we observed native free draining pit run sand and gravel at the east light pole foundation at a depth of approximately 5 to 5 ½ feet below sidewalk grade. Therefore, it may be advantageous to advance an excavation into the underlying free draining sand and gravel and back fill with drainage material to the subgrade of the Silva Cells to provide additional drainage for the cells.

At the time of our site visits on Tuesday and Wednesday October 6th and 7th the clayey sand subgrade soil was in a stiff to very stiff condition except for the location where a drain line had leaked and had caused some near surface water to puddle at subgrade elevation. The wet soil at subgrade should be excavated to the underlying stiff to very stiff clayey sand prior to constructing the Silva Cells.

We appreciate the opportunity to assist you on this phase of the project if you have any questions please do not hesitate to contact us at 208.376.8200.

Sincerely,
STRATA

Luke Calkins
Construction Services Manager

Daniel P. Gado

Daniel P. Gado, P.E.
Senior Engineer

DPG/hb

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Appendix D: Construction Project Plan Set

BOISE
DOWN TOWN
2015 WESTSIDE DISTRICT
STREETSCAPES

11TH - THIS YEAR'S CHIP SEAL SCHEDULE

MAIN - LIMIT AC CUT
ALLEY - PREFER NOT TO ENFORCE 2' AC CUTS
* ONLY WHERE NECESSARY

CAPITAL CITY DEVELOPMENT CORPORATION

JOHN BRUNELLE	Executive Director		
JOHN HALE	Chairman	DAVID EBERLE	Commissioner
DANA ZUCKERMAN	Vice Chairman	DAVID BIETER	Commissioner
PATRICK SHALZ	Sec/Treasurer	RYAN WOODINGS	Commissioner
LAUREN McLEAN	Commissioner	STACY PEARSON	Commissioner

BID SET 5-27-2015

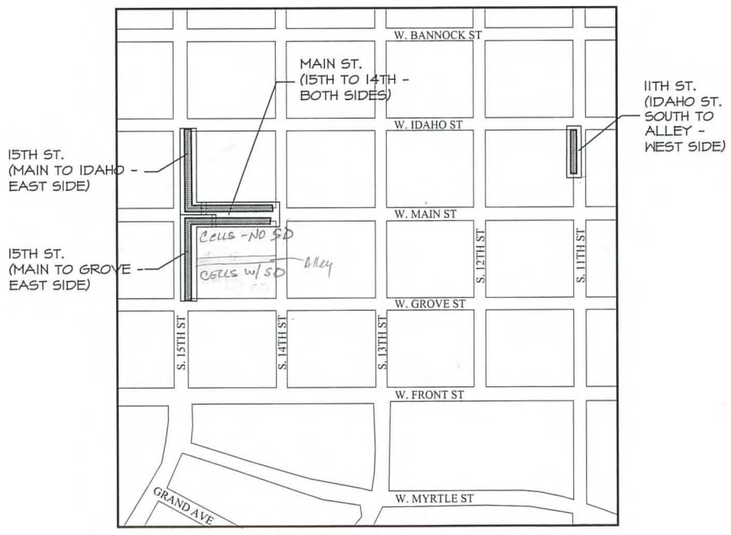
CONSULTANTS:

Landscape Architects:
JENSEN BELTS ASSOCIATES
495 Main Street
Boise, Idaho 83702
(208) 343-7175

Civil Engineers:
QUADRANT CONSULTING, INC.
1904 W. Overland Road
Boise, Idaho 83705
(208) 342-0091

Structural Engineers:
ALLY STRUCTURAL CONSULTING, LLC
3778 Plantation River, Suite 102
Boise, Idaho, 83703
(208) 949-5993

Electrical Engineers:
MUSGROVE ENGINEERING, PA
234 S. Whisperwood Way
Boise, Idaho 83709
(208) 384-0585



VICINITY MAP
15th St., Main St., and 11th St.

LIST OF DRAWINGS

Civil Drawings:
C-1 Civil Notes
C-2 Civil Details
C-3 Civil Details
C-4 Demolition Plan - 15th St. & Main St. (Main St to Idaho St - east side)
C-5 Demolition Plan - Main St. - east end (15th -14th St)
C-6 Demolition Plan - 15th St. & Main St. (Main St to Grove St - east side)
C-7 Demolition Plan - 11th St. (Idaho St. south to alley - west side)
C-8 Site Civil Plan - 15th St. & Main St. (Main St to Idaho St - east side)
C-9 Site Civil Plan - Main St. - east end (15th -14th St)
C-10 Site Civil Plan - 15th St. & Main St. (Main St to Grove St - east side)
C-11 Site Civil Plan - 11th St. (Idaho St. south to alley - west side)
C-12 Silva Cell Plan - Main St. (15th -14th St)
C-13 Silva Cell Plan - 15th St. (Main St to Grove St - east side)
ESC-1 Erosion and Sediment Control Plan - 15th St. & Main St. (Main St to Idaho St - east side)
ESC-2 Erosion and Sediment Control Plan - Main St. - east end (15th -14th St)
ESC-3 Erosion and Sediment Control Plan - 15th St. & Main St. (Main St to Grove St - east side)
ESC-4 Erosion and Sediment Control Plan - 11th St. (Idaho St. south to alley - west side)

Streetscape Drawings
ST-1 Streetscape Notes
ST-2 Streetscape Details
ST-3 Streetscape Details
ST-4 Streetscape Plan - 15th St. & Main St. (Main St to Idaho St - east side)
ST-5 Streetscape Plan - Main St. - east end (15th -14th St)
ST-6 Streetscape Plan - 15th St. & Main St. (Main St to Grove St - east side)
ST-7 Streetscape Plan - 11th St. (Idaho St. south to alley - west side)
ST-8 Streetscape Specifications

Electrical Drawings:
EG-1 Electrical Legends and Schedules
EG-2 Electrical Specifications
EG-3 Electrical Specifications
E-1 Electrical Plan - 15th St. & Main St. (Main St to Idaho St - east side)
E-2 Electrical Plan - Main St. - east end (15th -14th St)
E-3 Electrical Plan - 15th St. & Main St. (Main St to Grove St - east side)
E-4 Electrical Plan - 11th St. (Idaho St. south to alley - west side)
E-5 Electrical Details

Structural Drawings:
S-1.1 Structural

Plans Are Accepted For Public Street Construction

By stamping and signing the improvement plans, the Registered Engineer ensures the District that the plans conform to all District policies and standards. Variances or waivers must be specifically and previously approved by the District in writing. Acceptance of the improvement plans by the District does not relieve the Registered Engineer of these responsibilities.

BY _____ DATE: 5.29.15
ADA COUNTY HIGHWAY DISTRICT

RECEIVED
JUN 03 2015

CCDC STREETSCAPES WESTSIDE DISTRICT COMIS-0027

LEGEND

- 5/8" REBAR
- 1/2" REBAR
- MAGNETIC NAIL
- TEMPORARY BENCH MARK
- BRASS/ALUMINUM CAP
- GROUND WATER MONITORING WELL
- DECIDUOUS TREE
- STORM DRAIN MANHOLE
- STORM DRAIN GRATE
- ROOF DRAIN
- STORM DRAIN GRATE
- IRRIGATION MANHOLE
- IRRIGATION CONTROL VALVE
- ELECTRICAL MANHOLE
- ELECTRICAL BOX
- SANITARY SEWER MANHOLE
- SANITARY SEWER CLEAN OUT
- LIGHT POLE
- POWER POLE
- FIRE HYDRANT
- WATER VALVE
- BLOWOFF VALVE
- WATER METER
- FIRE DEPARTMENT CONNECTION
- WATER FAUCET
- FROST FREE HYDRANT
- POST INDICATOR VALVE
- SIGN
- TRASH CAN
- SIGNAL BOX
- SIGNAL MANHOLE
- PLANTER
- PARKING METER
- GAS METER
- TELEPHONE PEDESTAL
- TELEPHONE MANHOLE
- FIBER OPTICS MANHOLE
- GEOTHERMAL MANHOLE
- BENCH
- PEDESTRIAN CROSSING POLE
- SIGNAL POLE
- ROAD CENTER LINE
- PROPERTY LINE
- GRADE BREAK
- FLOW LINE
- FENCE
- OVERHEAD POWER
- FIBER OPTICS LINE
- GAS LINE
- TELEPHONE LINE
- UNDERGROUND POWER
- SIGNAL LINE
- SANITARY SEWER LINE
- WATER LINE
- STORM DRAIN LINE
- GEOTHERMAL LINE
- EDGE OF PAVEMENT
- BUILDING EAVE LINE
- SAW CUT/MATCH LINE
- BUILDING
- EXISTING CONCRETE CURB
- CONCRETE CURB
- 7" CONCRETE CURB
- CURB TYPE TRANSITION
- NEW ASPHALT
- SILVA CELL (2) UNITS STACKED

GENERAL NOTES

1. CONTRACTOR SHALL VERIFY SITE CONDITIONS AND REPORT DISCREPANCIES TO THE ENGINEER PRIOR TO BEGINNING WORK.
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ALL PERMITS AND REQUIRED INSPECTIONS FOR THIS PROJECT.
3. SITE WORK OUTSIDE OF ADA COUNTY HIGHWAY DISTRICT RIGHT-OF-WAY SHALL CONFORM TO THE CURRENT EDITION OF THE IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION (ISPWC), EXCEPT AS MODIFIED BY THE CONSTRUCTION DOCUMENTS AND PROJECT SPECIAL PROVISIONS.
4. THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THIS PLAN IS BASED ON INFORMATION WE DEEM RELIABLE. HOWEVER, THE LOCATION AND CONFIGURATION IS NOT GUARANTEED. CONTRACTOR SHALL CALL DIGLINE 48 HOURS PRIOR TO CONSTRUCTION (342-1585).
5. THE PROPERTY BOUNDARIES SHOWN ON THESE PLANS ARE BASED ON PREVIOUSLY RECORDED INFORMATION AND FIELD MEASUREMENTS. NO PROPERTY PINS HAVE BEEN SET AND NO RECORD OF SURVEY HAS BEEN FILED.
6. CONTRACTOR SHALL RETAIN AND PROTECT EXISTING UTILITIES UNLESS OTHERWISE SHOWN. ANY UTILITIES DAMAGED BY CONTRACTOR DURING CONSTRUCTION SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE.
7. ANY CHANGES FROM THESE PLANS SHALL BE APPROVED BY THE DESIGN ENGINEER.
8. ALL CONSTRUCTION WITHIN ADA COUNTY HIGHWAY DISTRICT RIGHT-OF-WAY SHALL CONFORM TO THE CURRENT EDITION OF THE IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION (ISPWC) AND THE ACHD SUPPLEMENTAL SPECIFICATIONS, EXCEPT AS MODIFIED BY THE PROJECT SPECIAL PROVISIONS. NO EXCEPTIONS TO DISTRICT POLICY, STANDARDS, AND THE ISPWC WILL BE ALLOWED UNLESS SPECIFICALLY AND PREVIOUSLY APPROVED IN WRITING BY THE DISTRICT.
9. CONTRACTOR SHALL PROVIDE AND GAIN APPROVAL FOR TRAFFIC CONTROL PLANS WITH ADA COUNTY HIGHWAY DISTRICT AND IDAHO TRANSPORTATION DEPARTMENT.
10. CONTRACTOR SHALL REPAIR ANY ASPHALT STRIPING OBLITERATED DURING CONSTRUCTION.
11. REPLACE ANY EXISTING DAMAGED CURB, GUTTER AND SIDEWALK AND ANY THAT MAY BE DAMAGED DURING THE CONSTRUCTION OF THE PROPOSED DEVELOPMENT. COORDINATE WITH ACHD INSPECTOR TO DETERMINE EXTENT OF REPAIR.
12. ACTUAL FIELD CONDITIONS FOUND DURING THE WORK MAY REQUIRE ADDITIONAL PAVEMENT REPAIR BEYOND THE LIMITS SHOWN ON THE PLANS. THE FOLLOWING CONDITIONS ARE LISTED IN SECTION 6007.11.11 (HIGHWAY CUTS) OF THE ACHD POLICY MANUAL.
    1) ALL ASPHALT MATCH LINES FOR PAVEMENT REPAIR SHALL BE PARALLEL TO THE CENTERLINE OF THE STREET AND INCLUDE ANY AREA DAMAGED BY EQUIPMENT DURING TRENCHING REMOVAL OPERATIONS.
    2) IF THE CUMULATIVE DAMAGED PAVEMENT AREA EXCEEDS 50% OF THE TOTAL ROAD SURFACE, CONTRACTOR SHALL REPLACE THE ENTIRE ROADWAY SURFACE.
    3) CONTRACTOR SHALL REPLACE THE PAVEMENT SURFACE TO ENSURE MATCH LINE DOES NOT FALL WITHIN THE WHEEL PATH OF A LANE. MATCH LINE SHALL ONLY FALL IN THE CENTER OR EDGE OF A TRAVEL LANE.
    4) FLOWABLE FILL OR IMPORTED MATERIAL MAY BE REQUIRED IF THE NATIVE TRENCH MATERIAL IS DEEMED UNSUITABLE BY ACHD INSPECTOR, DOES NOT MEET COMPACTION STANDARDS OR TIME IS A CRITICAL FACTOR.
    5) ANY EXCEPTIONS TO THESE RULES SHALL BE PRE-APPROVED IN WRITING BY DISTRICT STAFF BEFORE CONSTRUCTION BEGINS.
13. ASPHALT REPAIR, AS NECESSARY, SHALL COMPLY WITH ISPWC STANDARD DRAWINGS SD-301, SD-303, AND SD-806 AS APPLICABLE.
14. CONTRACTOR SHALL CONTACT ACHD INSPECTION STAFF TO COORDINATE PLACEMENT OF PAVEMENT MARKINGS.
15. CONTRACTOR SHALL VERIFY EXISTING ELEVATIONS PRIOR TO PLACING ASPHALT OR CONCRETE. REPORT ANY DISCREPANCIES TO THE ENGINEER FOR REDESIGN IF NECESSARY.
16. CONSTRUCTION STAKING TO BE OWNER PROVIDED THROUGH QUADRANT CONSULTING, INC. (342-0091). CONTRACTOR SHALL PROVIDE 48 HOURS NOTICE FOR STAKING REQUESTS. THE FOLLOWING SERVICES WILL BE PROVIDED:
    1) SAW CUT LINE LAYOUT
    2) CURB AND GUTTER LAYOUT AT 25' INTERVALS (GRADE BREAKS, GRADE CHANGE, PC, PT)
    3) SIDEWALK GRADE BREAKS LAYOUT AT 25' INTERVALS
    4) LIGHT POLE LAYOUT
    5) SILVA CELL LAYOUT
    6) QUALITY CONTROL-VERIFY CURB FORMWORK ELEVATIONS PRIOR TO PLACING CONCRETE ADDITIONAL SURVEYING SERVICES DEEMED NECESSARY BY CONTRACTOR SHALL BE PROVIDED BY CONTRACTOR. ADDITIONAL RE-STAKING SERVICES BROUGHT ABOUT DUE TO CONTRACTOR'S NEGLIGENCE AND BEYOND THE SERVICES LISTED WILL BE PROVIDED ON A TIME AND MATERIALS BASIS UPON WRITTEN AUTHORIZATION FROM CONTRACTOR. THE COST TO COMPLETE AUTHORIZED RE-STAKING WILL BE DEDUCTED FROM CONTRACTOR'S FEE BY OWNER.
    7) CONTRACTOR SHALL IDENTIFY PROPERTY/ROW MONUMENTS TO BE DISTURBED/DISTROYED DURING CONSTRUCTION AND CONTACT QUADRANT CONSULTING, INC. TO SURVEY PROPERTY/ROW MONUMENTS PRIOR TO BEING DISTURBED/DISTROYED. QUADRANT CONSULTING, INC. SHALL RESET PROPERTY/ROW MONUMENTS FOLLOWING COMPLETION OF HARDSCAPES. SERVICES BROUGHT ABOUT DUE TO CONTRACTOR'S FAILURE TO CONTACT QUADRANT CONSULTING, INC. TO SURVEY PROPERTY/ROW MONUMENTS PRIOR TO BEING DISTURBED/DISTROYED WILL BE PROVIDED ON A TIME AND MATERIALS BASIS UPON WRITTEN AUTHORIZATION FROM CONTRACTOR. THE COST TO COMPLETE AUTHORIZED RESET OF PROPERTY/ROW MONUMENTS WILL BE DEDUCTED FROM CONTRACTOR'S FEE BY OWNER.
17. COORDINATE COMPACTION TESTING FOR SIDEWALK/ASPHALT SUBGRADE AND BASE COURSE WITHIN RIGHT-OF-WAY WITH ACHD INSPECTOR.
18. THE ENGINEER OF RECORD CERTIFIES THAT THE PLANS ARE PREPARED IN SUBSTANTIAL CONFORMANCE WITH THE ACHD POLICY AND STANDARDS IN EFFECT AT THE TIME OF PREPARATION. THE ENGINEER ACKNOWLEDGES THAT ACHD ASSUMES NO LIABILITY FOR ERRORS OR DEFICIENCIES IN THE DESIGN. ALL VARIANCES FROM ACHD POLICY SHALL BE APPROVED IN WRITING. THE FOLLOWING VARIANCES, LISTED BY DATE AND SHORT DESCRIPTION, WERE APPROVED FOR THE PROJECT: NONE.
19. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.0%. THERE ARE NO "TOLERANCES" ALLOWED.
20. IF CONTRACTOR ENCOUNTERS VAULTS NOTIFY ACHD IMMEDIATELY. ANY VAULTS ENCOUNTERED WILL REQUIRE COORDINATION BETWEEN ACHD LEGAL STAFF, ACHD DESIGN REVIEW, CCDC AND PROPERTY OWNERS.
21. CONTRACTOR SHALL REPAIR/ADJUST EXISTING LANDSCAPING AND IRRIGATION ADJACENT TO AND AFFECTED BY THE WORK.

GENERAL DEMOLITION NOTES

1. COORDINATE DEMOLITION WITH ACHD PERSONNEL TO VERIFY LOCATION AND ROUTING OF SIGNAL CONDUIT. CONTRACTOR SHALL RETAIN AND PROTECT ALL TRAFFIC SIGNAL INFRASTRUCTURE.
2. COORDINATE DEMOLITION OF STREET LIGHTING FACILITIES, INCLUDING CONDUIT AND ABANDONED J-BOXES, WITH BOISE CITY PUBLIC WORKS AND ELECTRICAL PLANS TO VERIFY LOCATION AND ROUTING OF EXISTING CIRCUITS PRIOR TO DEMOLITION.
3. RELIEF CUT WITHIN 12" OF BUILDING FACE ALONG ENTIRE SIDEWALK LENGTH PRIOR TO REMOVING CONCRETE. SAWCUT LINE NOT SHOWN ON PLAN.
4. CONTRACTOR SHALL PROTECT EXISTING BUILDING FACE FROM CONSTRUCTION RELATED DAMAGE. CONSTRUCTION RELATED DAMAGE, IF ANY, SHALL BE REPAIRED AT THE EXPENSE OF THE CONTRACTOR.
5. BUILDING WALLS AND ENTRIES SHALL BE PROTECTED FROM CONSTRUCTION RELATED DIRT, DEBRIS, WASTEWATER FROM CONCRETE CUTTING OPERATIONS, ETC. TO THE EXTENT PRACTICAL. CONTRACTOR SHALL CLEAN ALL CONSTRUCTION RELATED DIRT, DEBRIS, DISCOLORATION, ETC. FROM BUILDING AND ENTRIES UPON COMPLETION OF THE WORK.
6. MATERIAL/SOIL EXCAVATED FOR SILVA CELL INSTALLATION SHALL BE DISPOSED OFF-SITE.
7. CONTRACTOR SHALL SALVAGE SIGNS ON LIGHT POLES AND RESET ON NEW POST FOLLOWING COMPLETION OF STREETSCAPE.

ABBREVIATIONS

EX	EXISTING
TBC	TOP BACK OF CURB
TC	TOP OF CONCRETE
AC	ASPHALT CONCRETE
GB	GRADE BREAK
TP	TOP OF PAVER
LIP	LIP OF CURB GUTTER PAN

IDAHO UTILITY NOTIFICATION CENTER 1-800-342-1585 STOP-CALL BEFORE YOU DIG!

CONTRACTOR SHALL NOTIFY DIG LINE AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION ON THIS PROJECT. CONTRACTOR IS ALSO RESPONSIBLE FOR NOTIFYING UTILITY COMPANIES BEFORE DIGGING ADJACENT TO ANY EXISTING UTILITIES.

DIG LINE, INC.
3350 AMERICANA TERRACE, STE. 370
BOISE, ID 83706
FAX: 1-800-342-1586

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

SPECIAL PROVISIONS

MODIFICATIONS TO THE IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION

1. 1103--CONSTRUCTION TRAFFIC CONTROL

1103.1.1 SECTION INCLUDES:

- DELETE THE SECTION AND ADD THE FOLLOWING:

CONTRACTOR SHALL FURNISH ALL PLANS, MATERIALS AND EQUIPMENT NECESSARY FOR MAINTENANCE OF TRAFFIC CONTROL IN CONFORMANCE WITH THE LATEST EDITION OF THE IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION (ISPWC), SUPPLEMENTED BY THE ADA COUNTY HIGHWAY DISTRICT (ACHD) SUPPLEMENTAL SPECIFICATIONS.

AT ALL TIMES WITHIN THE LIMITS OF THIS CONTRACT, ALL STREETS SHALL REMAIN OPEN FOR THROUGH TRAFFIC UNLESS OTHERWISE SPECIFIED. COORDINATE WITH ACHD FOR ANY LANE CLOSURES THAT MAY BE REQUIRED.

SUBMIT TRAFFIC CONTROL PLANS FOR APPROVAL TO THE ADA COUNTY HIGHWAY DISTRICT, AND PROJECT MANAGER. MAINTAIN TRAFFIC CONTROL AT THE SITE AT ALL TIMES. UPON ARRIVAL AND LEAVING THE JOB SITE, VERIFY THAT TRAFFIC CONTROL MARKERS ARE INTACT AND INSTALLED PER TRAFFIC CONTROL PLAN.

2. 1103.1.4--LOCAL AND EMERGENCY TRAFFIC

ADD THE FOLLOWING SUBSECTION:

- OPEN ACCESS SHALL BE MAINTAINED AT ALL TIMES FOR ALLEYS USED FOR DELIVERIES, ANY STREET PARKING LOCATION WHICH HAS BEEN DESIGNATED FOR BUSINESS LOADING USE, CONSTRUCTION SITES, AND PRIVATE DRIVEWAYS.
- CONTRACTOR'S VEHICLES SHALL NOT BE PARKED IN ANY STREET PARKING LOCATION WHICH HAS BEEN DESIGNATED FOR BUSINESS LOADING USE. PARKING FOR CONTRACTOR'S PERSONNEL SHALL NOT BE PERMITTED WITHIN THE PROJECT LIMITS. OFF-SITE PARKING FOR PERSONAL VEHICLES OF CONTRACTOR'S EMPLOYEES SHALL BE IN COMPLIANCE WITH BOISE CITY PARKING REGULATIONS.

3. 1103.1.5--PROTECTION OF PEDESTRIAN AND VEHICULAR TRAFFIC

ADD THE FOLLOWING SUBSECTION:

- PEDESTRIAN CROSSWALK ACCESS SHALL BE MAINTAINED TO THE MAXIMUM PRACTICAL EXTENT AT ALL TIMES.
- PEDESTRIAN ACCESS, AND THE METHOD THEREOF, SHALL BE MAINTAINED TO ALL BUSINESSES DURING THE COURSE OF CONSTRUCTION. SHOULD A PRIMARY BUSINESS ACCESS BE TEMPORARILY DISRUPTED, AN APPROVED ALTERNATE ACCESS SHALL BE PROVIDED ALONG WITH LEGIBLE SIGNAGE DIRECTING PEDESTRIANS TO ALTERNATE ACCESS.
- ALL TEMPORARY PEDESTRIAN PATHWAYS AND ACCESS LOCATIONS SHALL BE COMPLIANT WITH THE AMERICANS WITH DISABILITIES ACT.

SP-1250--DEMOLITION

DESCRIPTION

THIS TASK INCLUDES DEMOLITION RELATED TO SIDEWALK BASEMENT VAULTS (AS APPLICABLE), CONCRETE/BRICK SIDEWALK, CURB AND GUTTER, EXISTING UTILITIES, AND ASPHALT PAVING AS DESCRIBED IN THE CONTRACT DOCUMENTS. CONTRACTOR SHALL RETAIN AND PROTECT SPECIFIED SURFACE FEATURES, CURB WORK, AND ABOVE GRADE, OR INTEGRALLY TIED-IN UTILITIES AS SHOWN IN THE CONTRACT DOCUMENTS.

CONTRACTOR WILL ENCOUNTER ACHD FIBER OPTIC SIGNAL INTERCONNECT CONDUIT AND BOISE CITY STREET LIGHT CONDUIT AND WIRING CONTRACTOR IS RESPONSIBLE TO RETAIN AND PROTECT ALL EXISTING CIRCUITS AND RELATED APPURTENANCES, AND TO MAKE ALL REPAIRS TO DAMAGES UNLESS OTHERWISE NOTED.

NOTIFY CCDC'S PROJECT MANAGER AS SOON AS CONFLICTS WITH UNKNOWN UTILITIES, MATERIALS, AND CONSTRUCTION TECHNIQUES ARE DISCOVERED. CONTRACTOR SHALL REPAIR AT CONTRACTOR'S EXPENSE ALL DAMAGE CAUSED BY CONTRACTOR TO UTILITIES NOT OTHERWISE SHOWN TO BE ABANDONED OR REMOVED.

CONTRACTOR SHALL CONFORM TO THE LATEST EDITION OF THE IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION (ISPWC), AS SUPPLEMENTED BY THE ADA COUNTY HIGHWAY DISTRICT (ACHD), DIVISION 200, EARTHWORK, SECTION 201--CLEARING, GRUBBING AND REMOVAL OF OBSTRUCTIONS WITH THE ADDITIONAL REQUIREMENT TO CONFORM TO THE ACTUAL LIMITS OF WORK AND THIS SPECIAL PROVISION. FOLLOWING REMOVAL OF ITEMS COVERED IN THIS SPECIAL PROVISION AND AS SHOWN ON THE DRAWINGS, SECTION 202.3.7-- EXCAVATION OF UNSUITABLE MATERIAL SHALL APPLY.

CONTRACTOR SHALL PROVIDE FENCING SUFFICIENT TO IMPEDE PUBLIC ENTRY INTO SIDEWALK VAULTS OR OPEN EXCAVATION AS APPLICABLE DURING, AND UNTIL COMPLETION OF, CONSTRUCTION ACTIVITY. MAINTAIN TEMPORARY BUSINESS ACCESS AT ALL BUSINESSES ADJACENT TO VAULT OR OPEN EXCAVATION LOCATIONS UNTIL SIDEWALK HAS BEEN RECONSTRUCTED AND DEEMED SAFE FOR PEDESTRIAN USE.

SAW CUT ALONG FACE OF BUILDINGS, AND AT LIMITS OF PAVING TO BE REMOVED AS INDICATED ON THE DRAWINGS OR IN THE GENERAL DEMOLITION NOTES. PROTECT ALL RETAINED STRUCTURES AND SURFACES FROM DAMAGE.

AFTER THE NECESSARY SAW CUTTING HAS BEEN COMPLETED, CAREFULLY REMOVE REQUIRED PAVING. USE EXTRA CAUTION WHEN REMOVING SIDEWALK PORTIONS AT FACE OF BUILDING. CONTRACTOR SHALL REPAIR AT CONTRACTOR'S EXPENSE ALL DAMAGE CAUSED BY CONTRACTOR TO SURFACES, STRUCTURES AND UTILITIES NOT SCHEDULED FOR REMOVAL OR ALTERATION, OR SHALL REPLACE SUCH SURFACES, STRUCTURES AND UTILITIES IF BEYOND REPAIR. ASPHALT PATCHING, AND ALL TRAFFIC CONTROL SHALL BE IN STRICT CONFORMANCE WITH ACHD STANDARD REQUIREMENTS. TRAFFIC SIGNALS AND ALL OTHER UTILITY SERVICES SHALL REMAIN IN FULL AND CONTINUOUS SERVICE. TEMPORARY DISRUPTION TO UTILITY SERVICES SHALL BE COORDINATED PRIOR TO DISRUPTION.

CONTRACTOR SHALL COMPLY WITH ACHD REQUIREMENTS REGARDING CLOSURE AND SCHEDULING FOR VEHICULAR AND PEDESTRIAN AREAS AND ACTIVITIES IN THE PUBLIC RIGHT OF WAYS. CONTRACTOR SHALL COORDINATE WITH ADJACENT PROPERTY OWNERS REGARDING DEMOLITION ACTIVITIES AND SCHEDULING TO MINIMIZE DISRUPTION OF NORMAL BUSINESS ACTIVITIES.

MATERIALS

CONTRACTOR SHALL FURNISH ALL EQUIPMENT REQUIRED TO PERFORM THE DEMOLITION IN ALL RESPECTS. DEMOLITION TASKS ARE INTENDED TO ALLOW FINAL CONSTRUCTION ACTIVITIES TO BE COMPLETED. CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF UNSUITABLE SUBGRADE AND REMOVAL OR RELOCATION OF UNKNOWN EXISTING STRUCTURES CONFLICTING WITH NECESSARY CONSTRUCTION ACTIVITIES TO A DEPTH OF 18 INCHES BELOW FINISHED GRADE. ADDITIONAL EXCAVATION OR REMOVAL/REPLACEMENT BELOW 18 INCHES SHALL BE PAID FOR ON A UNIT PRICE BASIS.

Plans Are Accepted For Public Street Construction

By stamping and signing the improvement plans, the Registered Engineer ensures the District that the plans conform to all District policies and standards. Variances or waivers must be specifically and previously approved by the District in writing. Acceptance of the improvement plans by the District does not relieve the Registered Engineer of these responsibilities.

BY _____ DATE: 5.29.15
ADA COUNTY HIGHWAY DISTRICT

Issue	
Description	D
PERMIT	4
BID SET	5

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA 5/22/15

JENSENBELL ASSOCIATES
Site Planning
Landscape Architecture
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
Fax (208) 343-7178
e-mail: jba@jensenbel

2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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RZ	RZ
Scale	As Sh

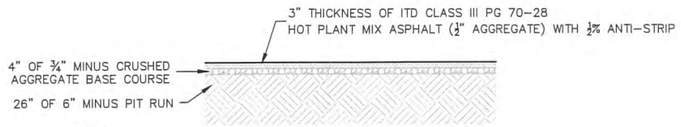
Sheet Title

CIVIL NOTE

Sheet Number

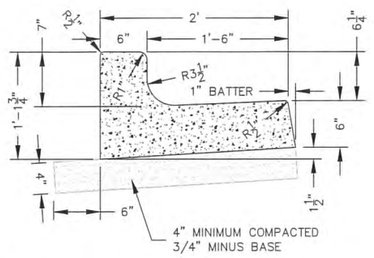
C-1

Of Sheet



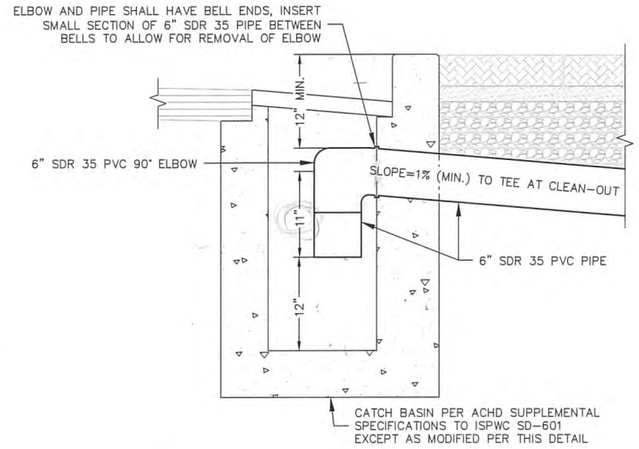
NOTES:
1. BASE COURSE AND PIT RUN COMPACTION TO EXCEED 95% ASTM D-698.
2. CONTRACTOR SHALL UTILIZE THE GREATER OF THE EXISTING PAVEMENT SECTION OR THE SECTION PROVIDED.

MAIN/11TH/15TH STREET TYPICAL SECTION — 1 / C-2
NTS



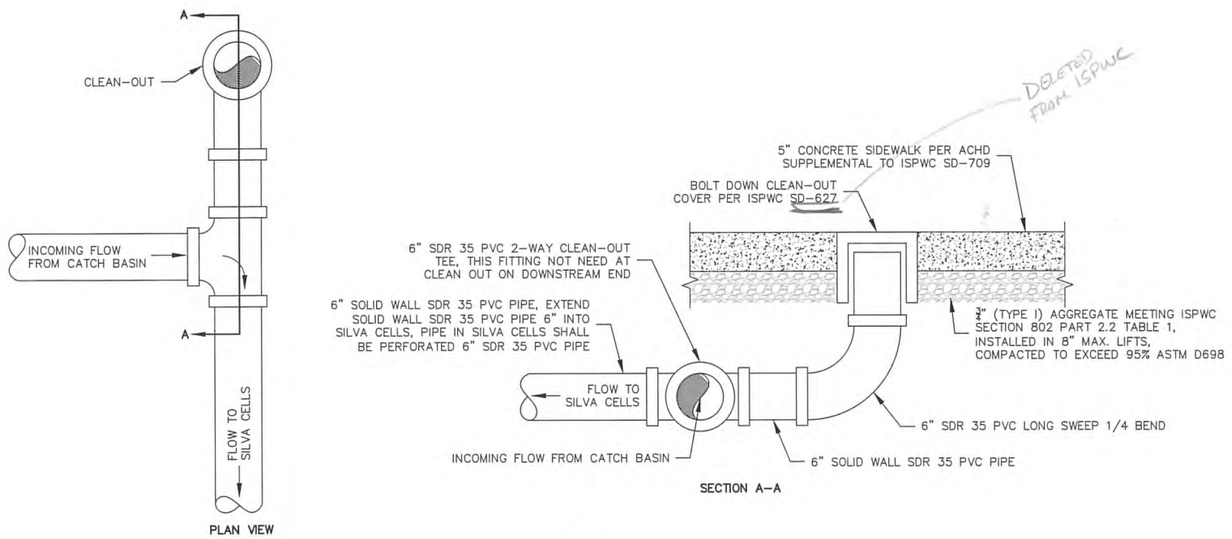
NOTES:
1. COMPACT 3/4" MINUS BASE TO EXCEED 95% OF STANDARD DENSITY.
2. 1/2-INCH PREFORMED EXPANSION JOINT MATERIAL (AASHTO M 213) AT TERMINAL POINTS OF RADII.
3. CONTINUOUS PLACEMENT PREFERRED, SCORE INTERVALS 10' MAX. SPACING (8FT. W/SIDEWALK.)
4. MATERIALS AND CONSTRUCTION IN COMPLIANCE WITH ISPWC SPECIFICATIONS.
5. BACKFILL AS PER SECTION 706.
6. CURB MEASURES 7"± FROM FLOW LINE TO TOP FACE.

7" VERTICAL CURB AND GUTTER — 2 / C-2
NTS

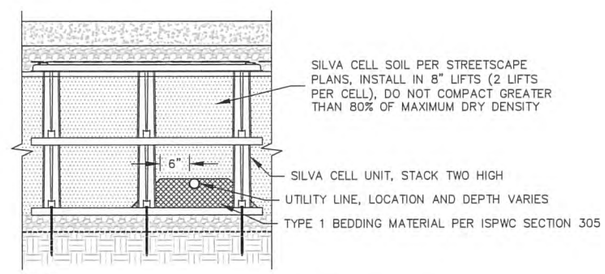


NOTES:
1. SDR 35 PVC PIPE SHALL BE SOLID WALL.
2. FIELD FIT PIPE SLOPE TO ALLOW INSTALLATION OF PERFORATED PIPE IN SILVA CELL AS HIGH AS POSSIBLE.

CATCH BASIN — 3 / C-2
NTS



TRAFFIC RATED CLEAN-OUT — 4 / C-2
NTS



NOTES:
1. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH DETAIL 1/C-3.
2. UTILITY LINE LOCATION AND DEPTH VARIES. UPON EXPOSING UTILITY LINE, CONTRACTOR SHALL CALL QUADRANT CONSULTING TO SURVEY UTILITY LINE LOCATION. THE PROJECT ENGINEER WILL ADJUST SILVA CELL DEPTH AND LAYOUT BASED ON ACTUAL UTILITY LINE LOCATION.

UTILITY LINE SUPPORT WITHIN SILVA CELLS PERPENDICULAR TO CURB (NTS) — 5 / C-2

Plans Are Accepted For Public Street Construction

By stamping and signing the improvement plans, the Registered Engineer ensures the District that the plans conform to all District policies and standards. Variances or waivers must be specifically and previously approved by the District in writing. Acceptance of the improvement plans by the District does not relieve the Registered Engineer of these responsibilities.

BY _____ DATE 5.29.15
ADA COUNTY HIGHWAY DISTRICT

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue Description	
PERMIT	
BID SET	5

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
5/22/15

JENSENBELL ASSOCIATES
Site Planning
Landscape Architectur
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
Fax (208) 343-7178
e-mail: jba@jensenbel

2015 WESTSIDE DISTRICT DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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C-2

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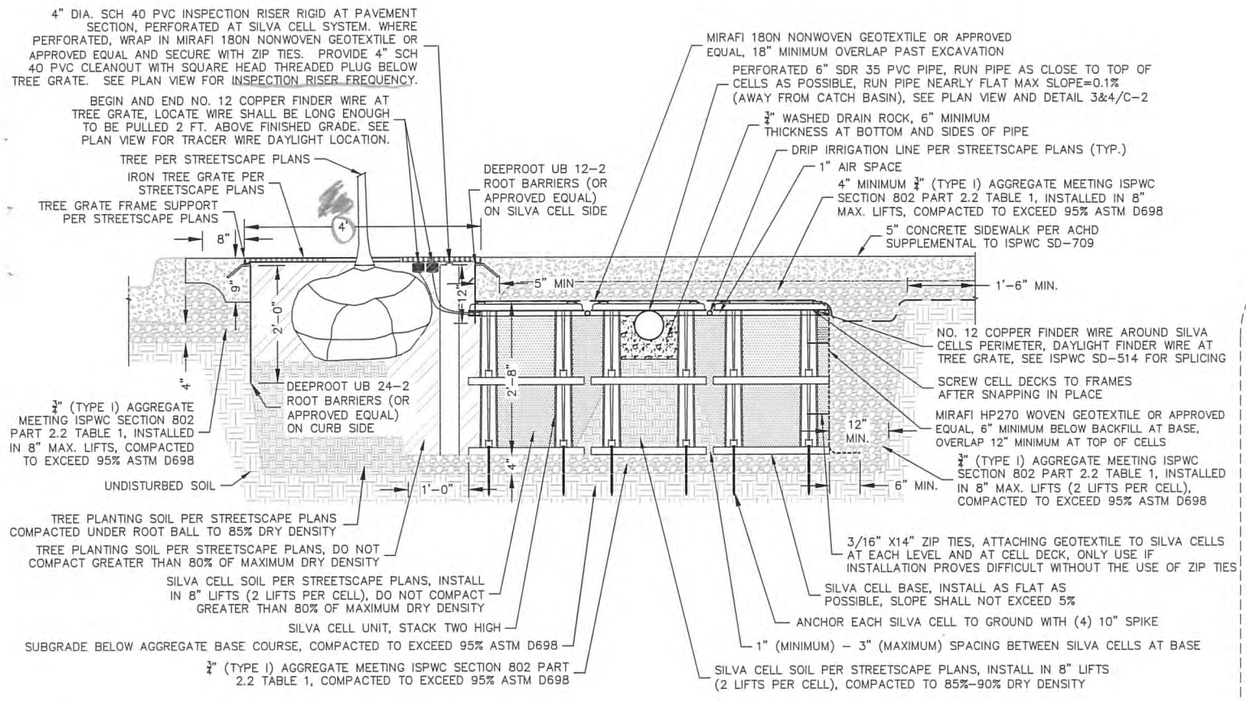
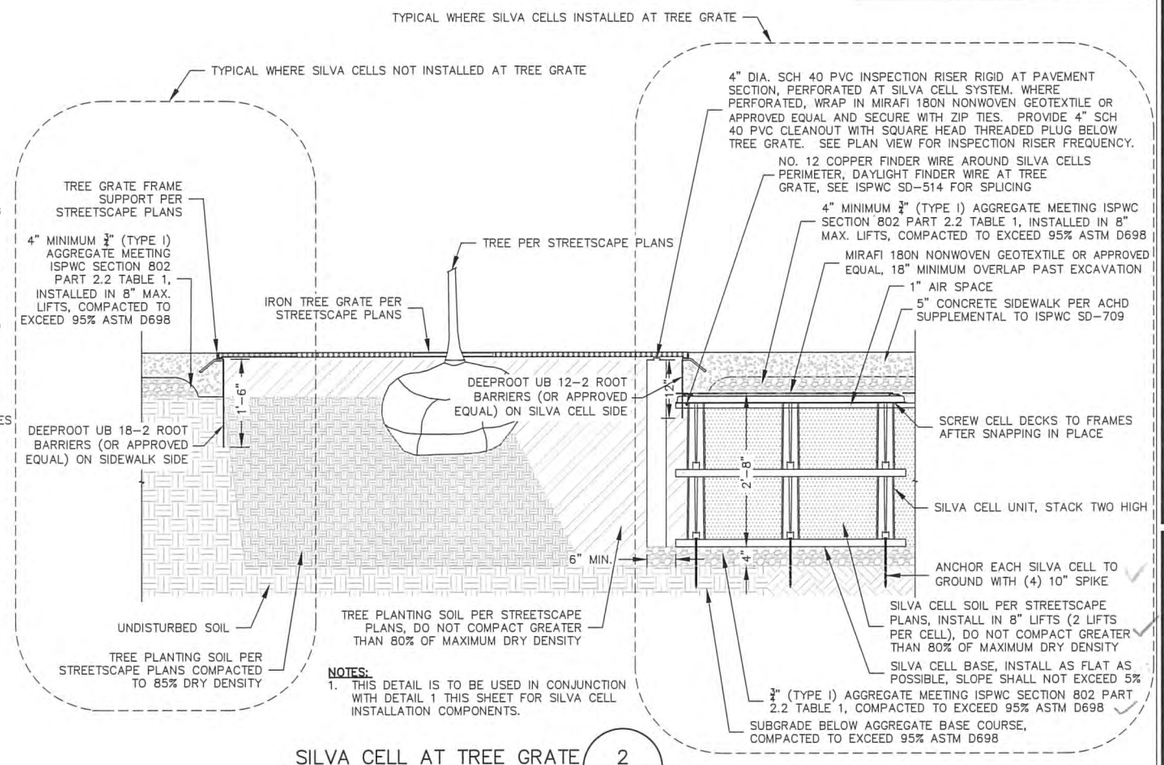


NOTES:

1. CONTRACTOR SHALL CONTACT DEEPROOT AND QUADRANT CONSULTING INC. TO SCHEDULE ON-SITE SUPERVISION PRIOR TO BEGINNING SILVA CELL INSTALLATION. FIVE WORKING DAYS NOTICE IS REQUIRED TO SCHEDULE ON-SITE SUPERVISION. CONTACT PAT GREELEY (DEEPROOT) AT 612-840-9004. CONTACT RICARDO ZAVALA (QUADRANT CONSULTING INC.) AT 208-342-0091.
2. CONTRACTOR SHALL CONTACT STRATA FOR COMPACTION TESTING AND SUBGRADE INSPECTION. STRATA SHALL INSPECT THE SUBGRADE AND DETERMINE IF GEOTEXTILE (MIRAFI HP270) IS NECESSARY PRIOR TO INSTALLATION OF SUBBASE. CALL GREG MUGAVERO AT 208-376-8200. FIVE WORKING DAYS NOTICE IS REQUIRED TO SCHEDULE INSPECTION.
3. INSTALL SILVA CELL PER SILVA CELL SPECIFICATION AND MANUFACTURE INSTALLATION INSTRUCTIONS.
4. SILVA CELL DIMENSIONS: 16" HEIGHT, 24" WIDE, 48" LENGTH.
6. MATERIAL/SOIL EXCAVATED FOR SILVA CELL INSTALLATION SHALL BE DISPOSED OFF-SITE.
7. INSTALL SILVA CELL FRAMES AROUND, OVER, OR UNDER EXISTING OR PROPOSED UTILITY LINES.
8. CONTRACTOR SHALL CONTACT CIVIL ENGINEER FOR INSPECTION OF FINDER WIRE AND INSPECTION RISER PRIOR TO INSTALLATION OF TREE GRATE.

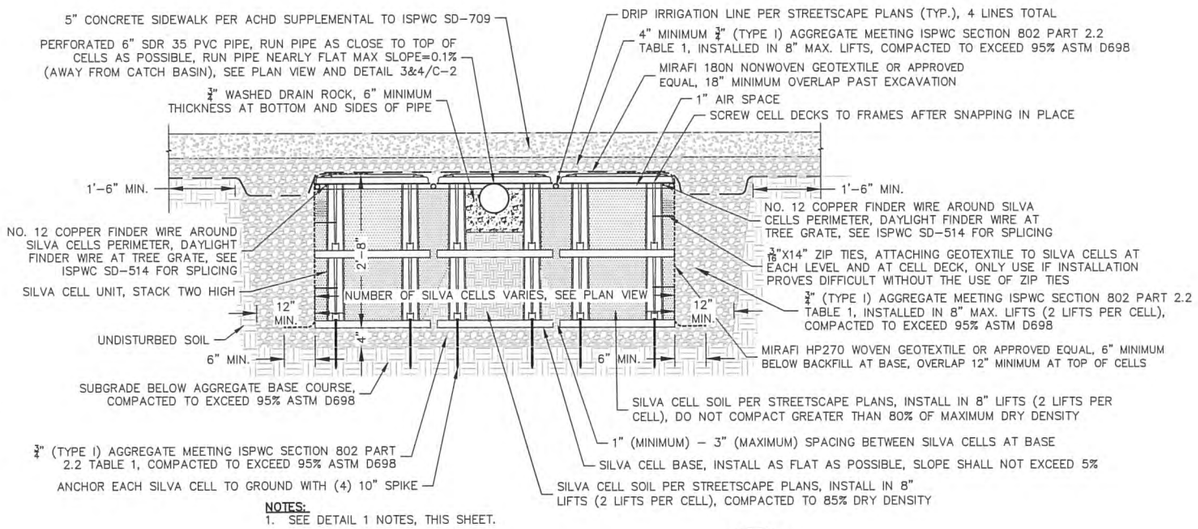
SILVA CELL AT TREE GRATE PERPENDICULAR TO CURB (NTS) — 1 / C-3



NOTES:

1. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH DETAIL 1 THIS SHEET FOR SILVA CELL INSTALLATION COMPONENTS.

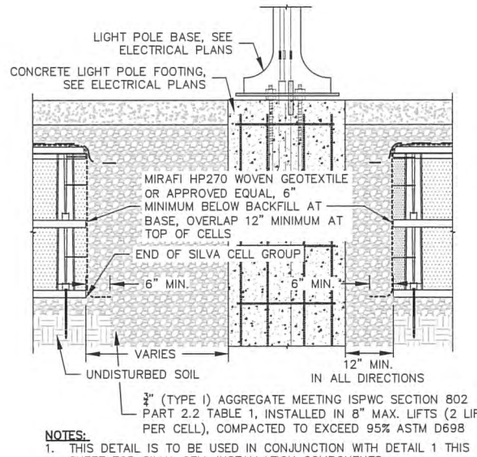
SILVA CELL AT TREE GRATE PARALLEL TO CURB (NTS) — 2 / C-3



NOTES:

1. SEE DETAIL 1 NOTES, THIS SHEET.

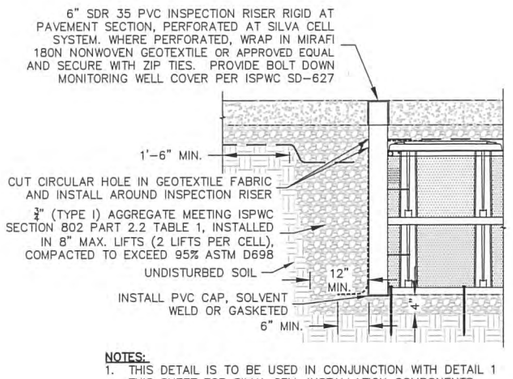
SILVA CELL BETWEEN TREES PERPENDICULAR TO CURB (NTS) — 3 / C-3



NOTES:

1. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH DETAIL 1 THIS SHEET FOR SILVA CELL INSTALLATION COMPONENTS.

SILVA CELL TERMINATION AT STREET LIGHT FOOTING PARALLEL TO CURB (NTS) — 4 / C-3



NOTES:

1. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH DETAIL 1 THIS SHEET FOR SILVA CELL INSTALLATION COMPONENTS.

MONITORING WELL PARALLEL TO CURB (NTS) — 5 / C-3

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BY _____ DATE 5.29.15
ADA COUNTY HIGHWAY DISTRICT

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue	
Description	
PERMIT	
BID SET	

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Javala STATE OF IDAHO RICARDO ZAVALA 5/22/15

JENSENBELL ASSOCIATES
Site Planning
Landscape Architectur
495 Main Street
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Fax (208) 343-7178
e-mail: jba@jensenbel

2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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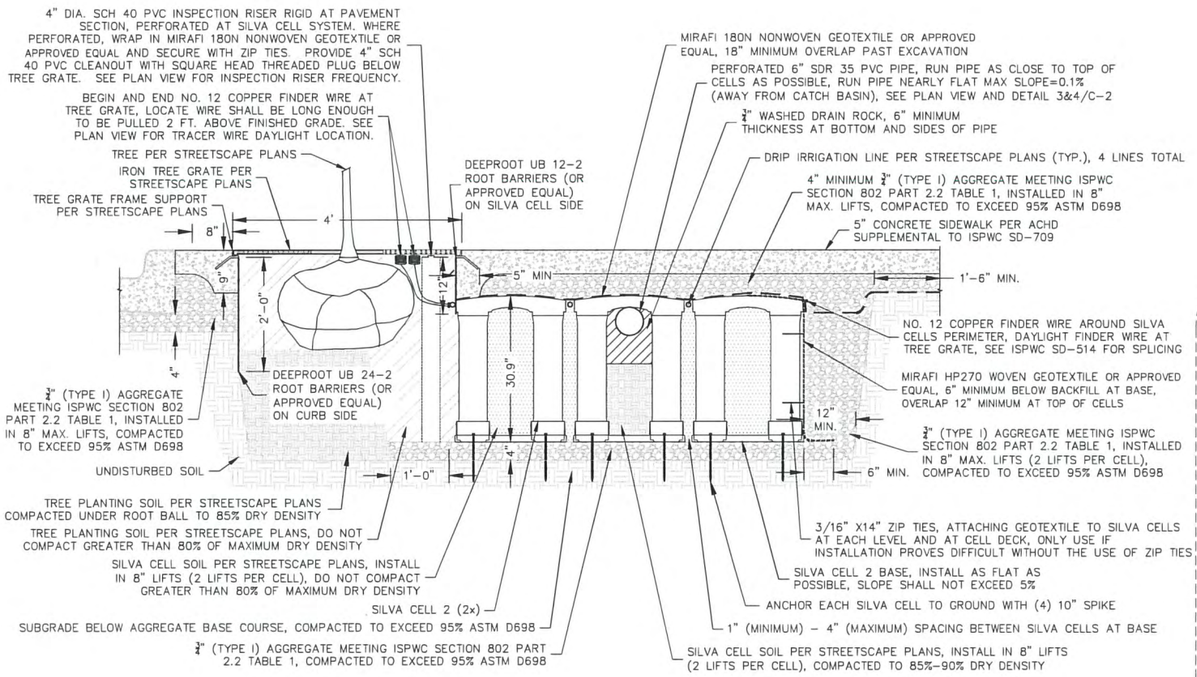

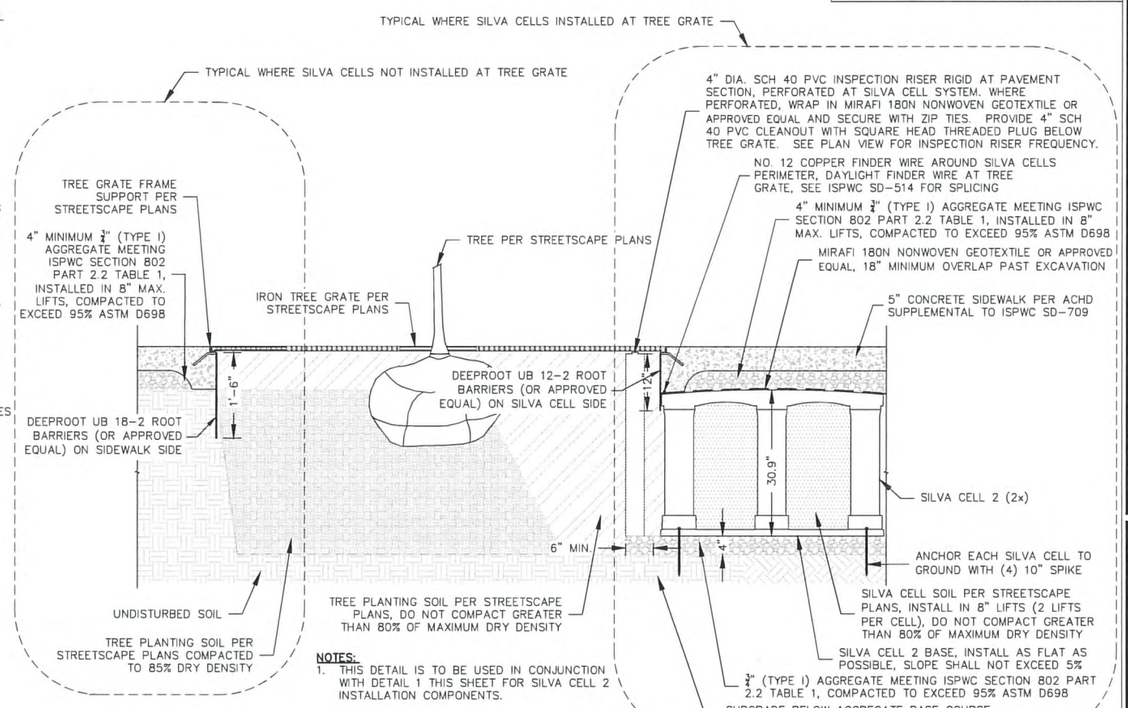

NOTES:
1. CONTRACTOR SHALL CONTACT DEEPROOT AND QUADRANT CONSULTING INC. TO SCHEDULE ON-SITE SUPERVISION PRIOR TO BEGINNING SILVA CELL INSTALLATION. FIVE WORKING DAYS NOTICE IS REQUIRED TO SCHEDULE ON-SITE SUPERVISION. CONTACT PAT GREELEY (DEEPROOT) AT 612-840-9004. CONTACT RICARDO ZAVALA (QUADRANT CONSULTING INC.) AT 208-342-0091.
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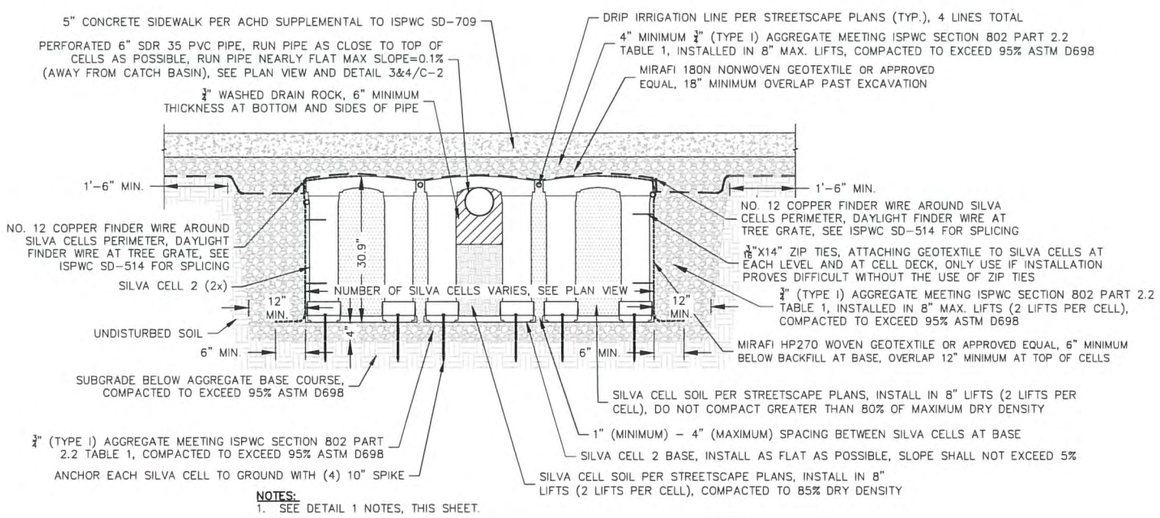
3. INSTALL SILVA CELL 2 PER SILVA CELL SPECIFICATION AND MANUFACTURE INSTALLATION INSTRUCTIONS.
4. SILVA CELL 2 (2X) DIMENSIONS: 30.9" HEIGHT, 24" WIDE, 48" LENGTH.
6. MATERIAL/SOIL EXCAVATED FOR SILVA CELL INSTALLATION SHALL BE DISPOSED OFF-SITE.
7. INSTALL SILVA 2 CELL FRAMES AROUND, OVER, OR UNDER EXISTING OR PROPOSED UTILITY LINES.
8. CONTRACTOR SHALL CONTACT CIVIL ENGINEER FOR INSPECTION OF FINDER WIRE AND INSPECTION RISER PRIOR TO INSTALLATION OF TREE GRATE.

SILVA CELL AT TREE GRATE PERPENDICULAR TO CURB (NTS) — 1 / C-3.1

NOTES:
1. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH DETAIL 1 THIS SHEET FOR SILVA CELL 2 INSTALLATION COMPONENTS.

SILVA CELL AT TREE GRATE PARALLEL TO CURB (NTS) — 2 / C-3.1



NOTES:
1. SEE DETAIL 1 NOTES, THIS SHEET.

SILVA CELL BETWEEN TREES PERPENDICULAR TO CURB (NTS) — 3 / C-3.1

Plans Are Accepted For Public Street Construction

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BY _____ DATE 10.9.15
ADA COUNTY HIGHWAY DISTRICT

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue Description	Date
PERMIT	4/8/14
BID SET	5/27/15
5 DESIGN REVISION #5	10/7/15
6 DESIGN REVISION #6	10/7/15

PROFESSIONAL ENGINEER LICENSED 15180 RICARDO ZAVALA STATE OF IDAHO
10/7/2015

JENSENBELTS ASSOCIATES
Site Planning
Landscape Architecture
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
Fax (208) 343-7178
e-mail: jba@jensenbelts.com

2015 WESTSIDE DISTRICT
STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 204-21

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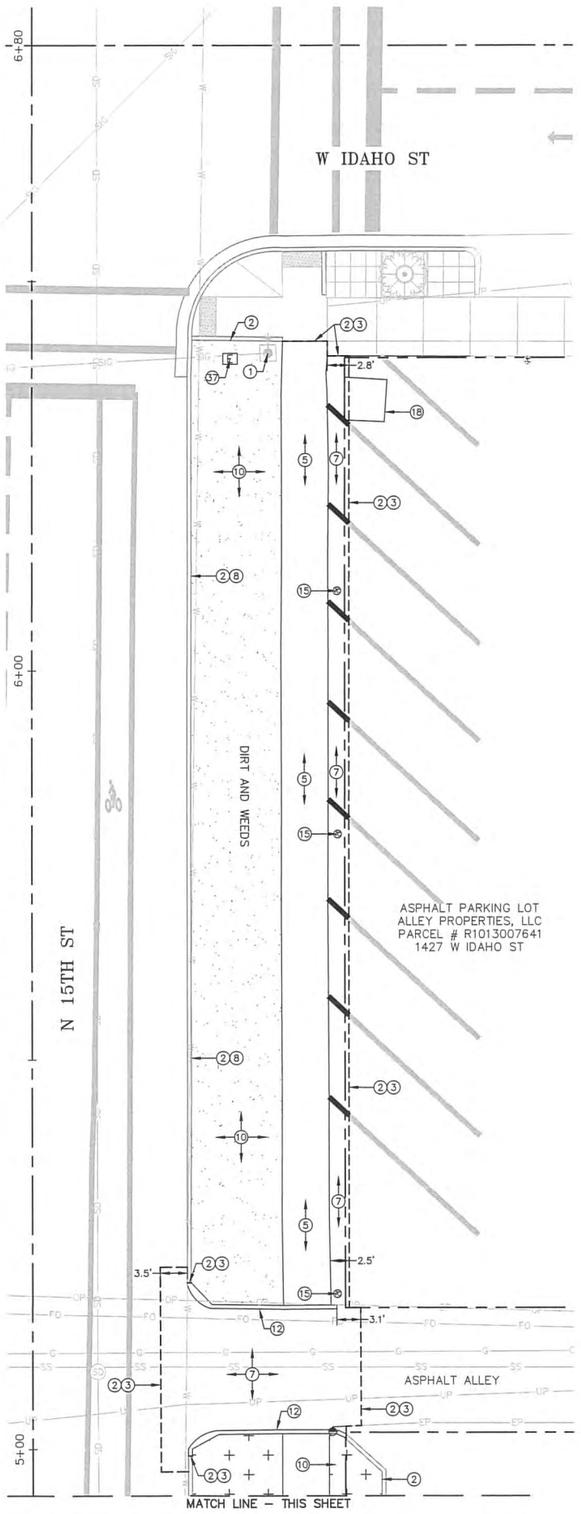
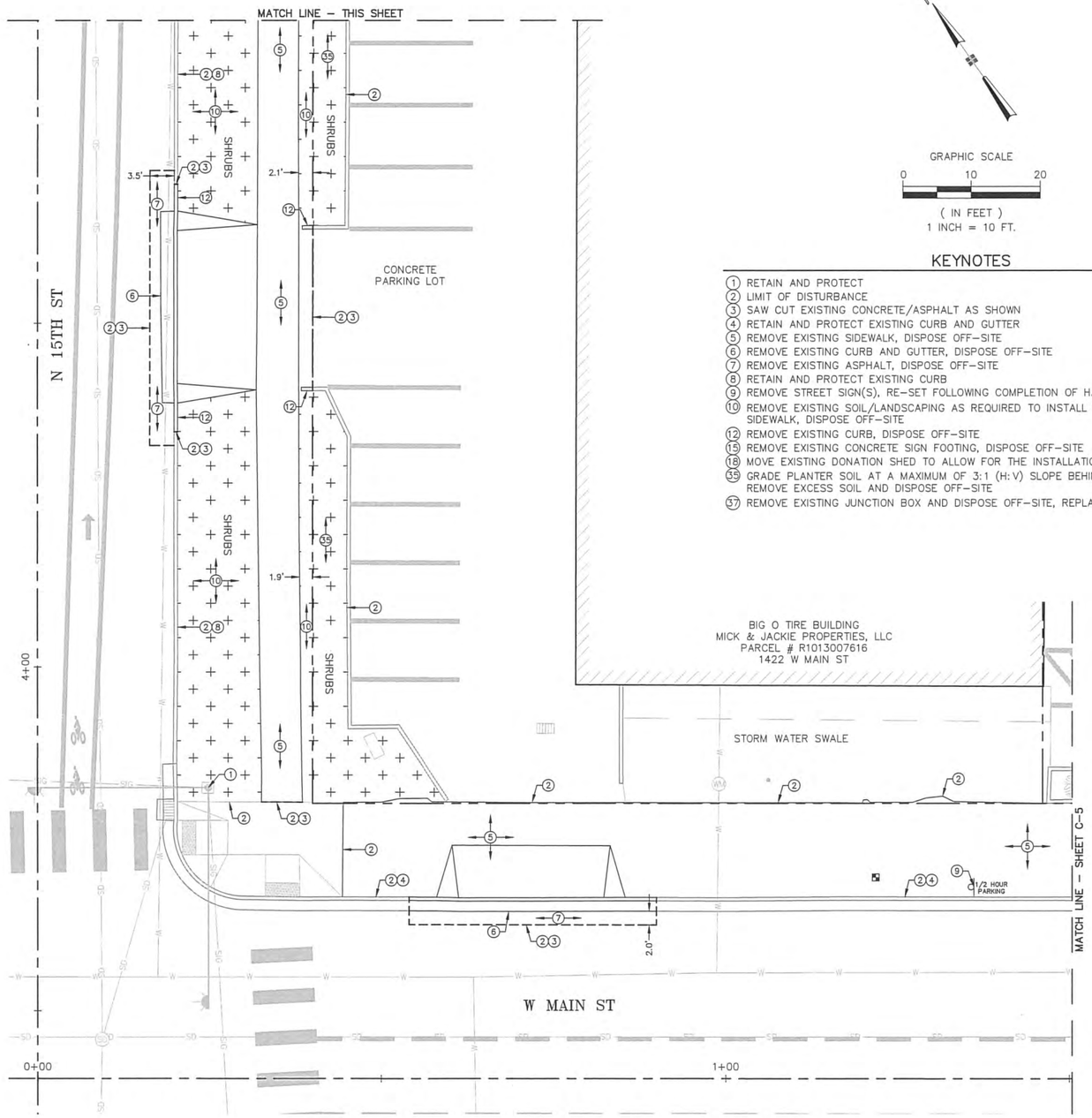
Scale	As Shown

Sheet Title
CIVIL DETAILS

Sheet Number
C-3.1
Of Sheets





GRAPHIC SCALE

0 10 20

(IN FEET)
1 INCH = 10 FT.

KEYNOTES

1. RETAIN AND PROTECT
2. LIMIT OF DISTURBANCE
3. SAW CUT EXISTING CONCRETE/ASPHALT AS SHOWN
4. RETAIN AND PROTECT EXISTING CURB AND GUTTER
5. REMOVE EXISTING SIDEWALK, DISPOSE OFF-SITE
6. REMOVE EXISTING CURB AND GUTTER, DISPOSE OFF-SITE
7. REMOVE EXISTING ASPHALT, DISPOSE OFF-SITE
8. RETAIN AND PROTECT EXISTING CURB
9. REMOVE STREET SIGN(S), RE-SET FOLLOWING COMPLETION OF HARDSCAPE
10. REMOVE EXISTING SOIL/LANDSCAPING AS REQUIRED TO INSTALL NEW LANDSCAPING AND SIDEWALK, DISPOSE OFF-SITE
12. REMOVE EXISTING CURB, DISPOSE OFF-SITE
15. REMOVE EXISTING CONCRETE SIGN FOOTING, DISPOSE OFF-SITE
18. MOVE EXISTING DONATION SHED TO ALLOW FOR THE INSTALLATION OF VERTICAL CURB
35. GRADE PLANTER SOIL AT A MAXIMUM OF 3:1 (H:V) SLOPE BEHIND PROPERTY LINE, REMOVE EXCESS SOIL AND DISPOSE OFF-SITE
37. REMOVE EXISTING JUNCTION BOX AND DISPOSE OFF-SITE, REPLACE PER CIVIL PLAN

15TH & MAIN STREET
(MAIN ST TO IDAHO ST - EAST SIDE)

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue	Description
PERMIT	
BID SET	

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
5/22/15

JENSENBELT ASSOCIATES
Site Planning
Landscape Architectur
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
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2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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Sheet Title
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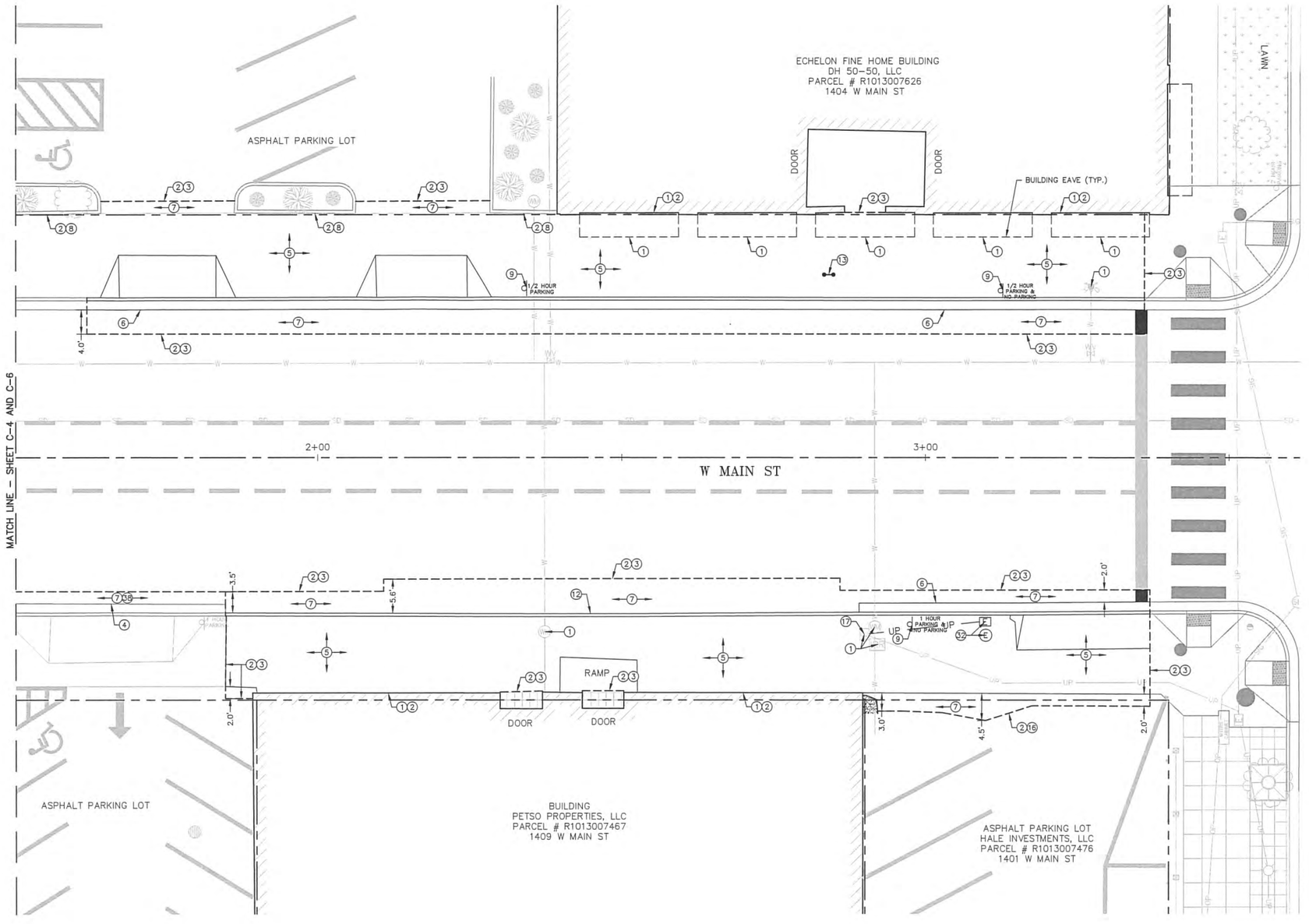
PLAN

Sheet Number
C-4
Of Sheet



MAIN STREET - EAST END
(15TH ST TO 14TH ST)

GRAPHIC SCALE
0 10 20
(IN FEET)
1 INCH = 10 FT.

KEYNOTES

(1) RETAIN AND PROTECT
(2) LIMIT OF DISTURBANCE
(3) SAW CUT EXISTING CONCRETE/ASPHALT AS SHOWN
(4) RETAIN AND PROTECT EXISTING CURB AND GUTTER
(5) REMOVE EXISTING SIDEWALK, DISPOSE OFF-SITE
(6) REMOVE EXISTING CURB AND GUTTER, DISPOSE OFF-SITE
(7) REMOVE EXISTING ASPHALT, DISPOSE OFF-SITE
(8) RETAIN AND PROTECT EXISTING CURB
(9) REMOVE STREET SIGN(S), RE-SET FOLLOWING COMPLETION OF HARDSCAPE
(12) REMOVE EXISTING CURB, DISPOSE OFF-SITE
(13) REMOVE BIKE RACKS, SALVAGE BIKE RACKS IN GOOD CONDITION TO CCDC, DELIVER TO WAREHOUSE AT 620 S. 9TH STREET IN BOISE, CONTACT GEOFF HUNDT AT 208-472-5252 TO DETERMINE BIKE RACK CONDITION, DISPOSE OF BIKE RACKS IN POOR CONDITION OFF-SITE
(16) SAW CUT ASPHALT ALONG EXISTING ASPHALT PATCH MATCH LINE
(17) SEE ELECTRICAL PLANS
(32) REMOVE EXISTING SONATUBE WITH MANHOLE COVER AND JUNCTION BOX, DISPOSE OFF-SITE, BACKFILL EXCAVATION WITH 6" MINUS PITRUN STRUCTURAL FILL COMPACTED TO EXCEED 95% ASTM D-698
(38) CONTRACTOR SHALL RETAIN ASPHALT IN FRONT OF DRIVEWAY AS LONG AS POSSIBLE IN ORDER TO MAINTAIN ACCESS TO PARKING LOT, AFTER ASPHALT IS DEMOLISHED TEMPORARILY FILL VOID WITH ¾" MINUS GRAVEL

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CIVIL ENGINEERING-SURVEYING

Issue	
Description	D
PERMIT	4
BID SET	5

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
5/22/15

JENSENBELT ASSOCIATES
Site Planning
Landscape Architecture
495 Main Street
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2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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Scale	As Sho

Sheet Title
DEMOLITIO PLAN

Sheet Number
C-5
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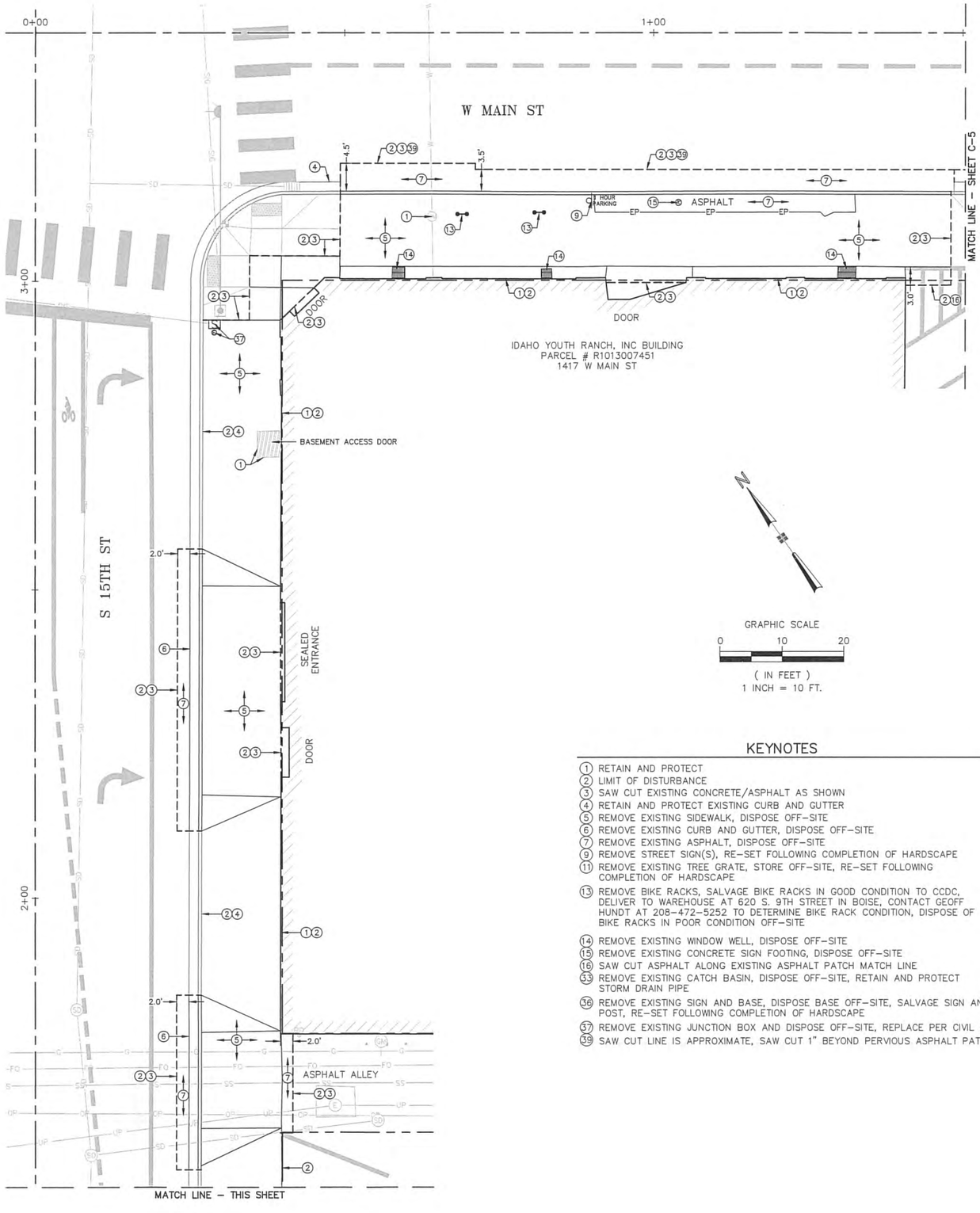
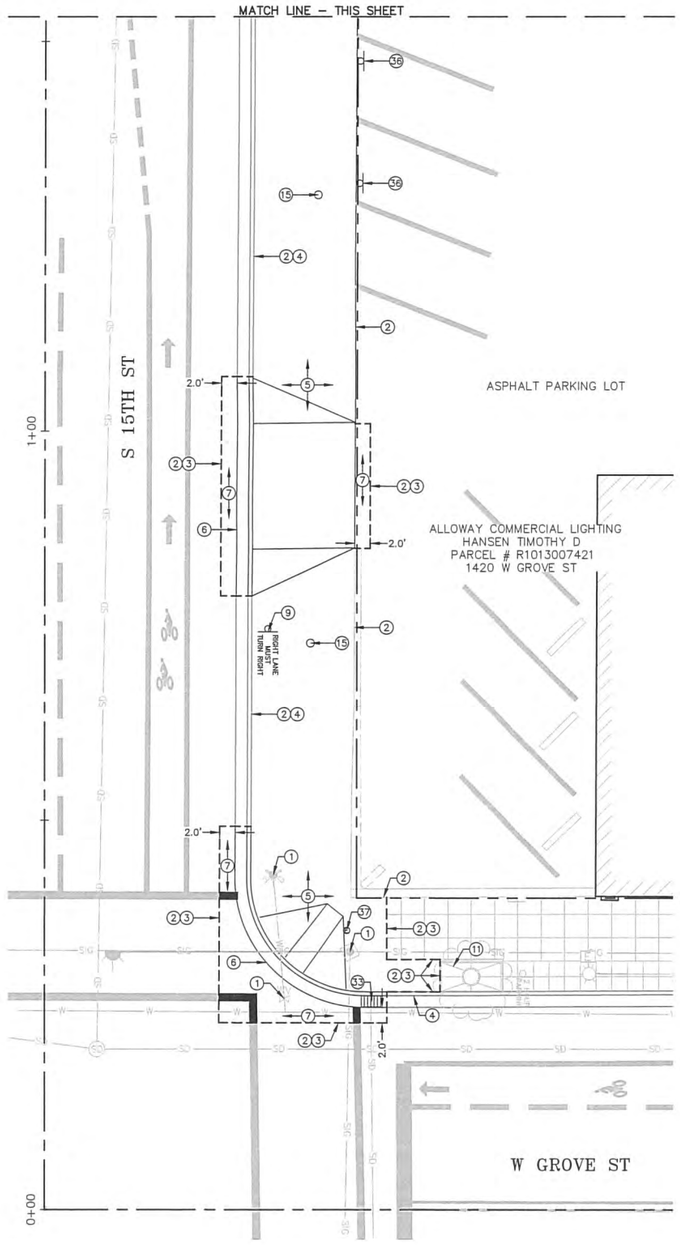


KEYNOTES

(1) RETAIN AND PROTECT
(2) LIMIT OF DISTURBANCE
(3) SAW CUT EXISTING CONCRETE/ASPHALT AS SHOWN
(4) RETAIN AND PROTECT EXISTING CURB AND GUTTER
(5) REMOVE EXISTING SIDEWALK, DISPOSE OFF-SITE
(6) REMOVE EXISTING CURB AND GUTTER, DISPOSE OFF-SITE
(7) REMOVE EXISTING ASPHALT, DISPOSE OFF-SITE
(9) REMOVE STREET SIGN(S), RE-SET FOLLOWING COMPLETION OF HARDSCAPE
(11) REMOVE EXISTING TREE GRATE, STORE OFF-SITE, RE-SET FOLLOWING COMPLETION OF HARDSCAPE
(13) REMOVE BIKE RACKS, SALVAGE BIKE RACKS IN GOOD CONDITION TO CCDC, DELIVER TO WAREHOUSE AT 620 S. 9TH STREET IN BOISE, CONTACT GEOFF HUNDT AT 208-472-5252 TO DETERMINE BIKE RACK CONDITION, DISPOSE OF BIKE RACKS IN POOR CONDITION OFF-SITE
(14) REMOVE EXISTING WINDOW WELL, DISPOSE OFF-SITE
(15) REMOVE EXISTING CONCRETE SIGN FOOTING, DISPOSE OFF-SITE
(16) SAW CUT ASPHALT ALONG EXISTING ASPHALT PATCH MATCH LINE
(33) REMOVE EXISTING CATCH BASIN, DISPOSE OFF-SITE, RETAIN AND PROTECT STORM DRAIN PIPE
(36) REMOVE EXISTING SIGN AND BASE, DISPOSE BASE OFF-SITE, SALVAGE SIGN AND POST, RE-SET FOLLOWING COMPLETION OF HARDSCAPE
(37) REMOVE EXISTING JUNCTION BOX AND DISPOSE OFF-SITE, REPLACE PER CIVIL PLAN
(39) SAW CUT LINE IS APPROXIMATE, SAW CUT 1" BEYOND PERVIOUS ASPHALT PATCH LINE



15TH & MAIN STREET
(MAIN ST TO GROVE ST - EAST SIDE)

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue	
Description	
PERMIT	
BID SET	

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
5/22/15

JENSENBELT ASSOCIATES
Site Planning
Landscape Architectur
495 Main Street
Boise, Idaho 83702
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Fax (208) 343-7178
e-mail: jba@jensenbel

2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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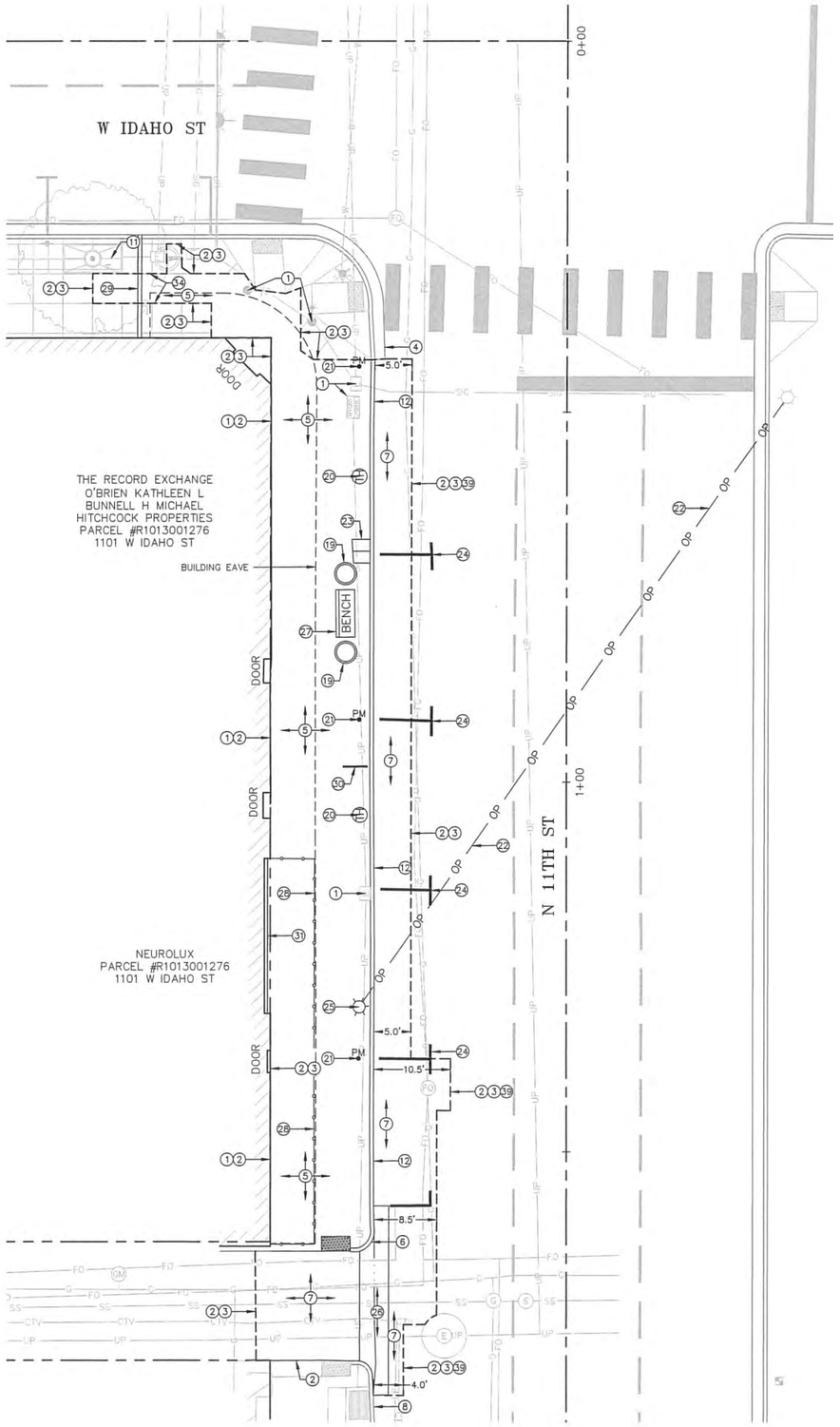
Sheet Title
DEMOLITIC
PLAN

Sheet Number
C-6
Of Sheet



11TH STREET
(IDAHO ST SOUTH TO ALLEY - WEST SIDE)

GRAPHIC SCALE
0 10 20
(IN FEET)
1 INCH = 10 FT.

KEYNOTES

(1) RETAIN AND PROTECT
(2) LIMIT OF DISTURBANCE
(3) SAW CUT EXISTING CONCRETE/ASPHALT AS SHOWN
(4) RETAIN AND PROTECT EXISTING CURB AND GUTTER
(5) REMOVE EXISTING SIDEWALK, DISPOSE OFF-SITE
(6) REMOVE EXISTING CURB AND GUTTER, DISPOSE OFF-SITE
(7) REMOVE EXISTING ASPHALT, DISPOSE OFF-SITE
(8) RETAIN AND PROTECT EXISTING CURB
(11) REMOVE EXISTING TREE GRATE, STORE OFF-SITE, RE-SET FOLLOWING COMPLETION OF HARDSCAPE
(12) REMOVE EXISTING CURB, DISPOSE OFF-SITE
(19) COORDINATE REMOVAL OF EXISTING PRECAST CONCRETE PLANTER WITH DOWNTOWN BOISE ASSOCIATION (385-7300)
(20) REMOVE TRASH RECEPTACLE, SALVAGE TRASH RECEPTACLE IN GOOD CONDITION TO CCDC, DELIVER TO WAREHOUSE AT 620 S. 9TH STREET IN BOISE, CONTACT GEOFF HUNDT AT 208-472-5252 TO DETERMINE TRASH RECEPTACLE CONDITION, DISPOSE OF TRASH RECEPTACLE IN POOR CONDITION OFF-SITE
(21) COORDINATE REMOVAL OF EXISTING PARKING METER WITH BOISE CITY PARKING
(22) REMOVE OVERHEAD POWER FEED TO STREET LIGHT AND COORDINATE SALVAGE BY IDAHO POWER, SEE ELECTRICAL PLANS
(23) REMOVE NEWSPAPER STAND(S), COORDINATE REMOVAL WITH NEWSPAPER COMPANY, STORE OFF-SITE, RESET FOLLOWING COMPLETION OF HARDSCAPE
(24) OBLITERATE PARKING STRIPING
(25) REMOVE EXISTING STREET LIGHT AND COORDINATE SALVAGE BY BOISE PUBLIC WORKS, REMOVE BASE AND DISPOSE OFF-SITE, BACKFILL EXCAVATION WITH 6" MINUS PITRUN STRUCTURAL FILL COMPACTED TO EXCEED 95% ASTM D-698, SEE ELECTRICAL PLANS
(26) REMOVE EXISTING VALLEY GUTTER, DISPOSE OFF-SITE
(27) REMOVE BENCH, SALVAGE TO CCDC, DELIVER TO WAREHOUSE AT 620 S. 9TH STREET IN BOISE
(28) REMOVE RAILING, COORDINATE REMOVAL WITH SHOP OWNER, STORE OFF-SITE, RESET FOLLOWING COMPLETION OF HARDSCAPE
(29) SALVAGE EXISTING ROOF DRAIN TRENCH GRATE, STORE OFF-SITE, RESET FOLLOWING COMPLETION OF HARDSCAPE
(30) REMOVE BIKE RACK, DISPOSE OFF-SITE
(31) REMOVE EXISTING STEEL ART PIECE FROM BUILDING WALL (APPROXIMATELY 12'X10'), COORDINATE REMOVAL WITH SHOP OWNER, STORE OFF-SITE, RESET FOLLOWING COMPLETION OF HARDSCAPE
(34) CONTACT CIVIL ENGINEER PRIOR TO SAW CUTTING SIDEWALK TO COORDINATE SAWCUT EXTENTS, SAWCUT ALONG SCORE JOINTS
(39) SAW CUT LINE IS APPROXIMATE, SAW CUT 1" BEYOND PERVIOUS ASPHALT PATCH LINE

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CIVIL ENGINEERING-SURVEYING

Issue	Description	D
PERMIT		
BID SET		5

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA 5/22/15

JENSENBELT ASSOCIATES
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2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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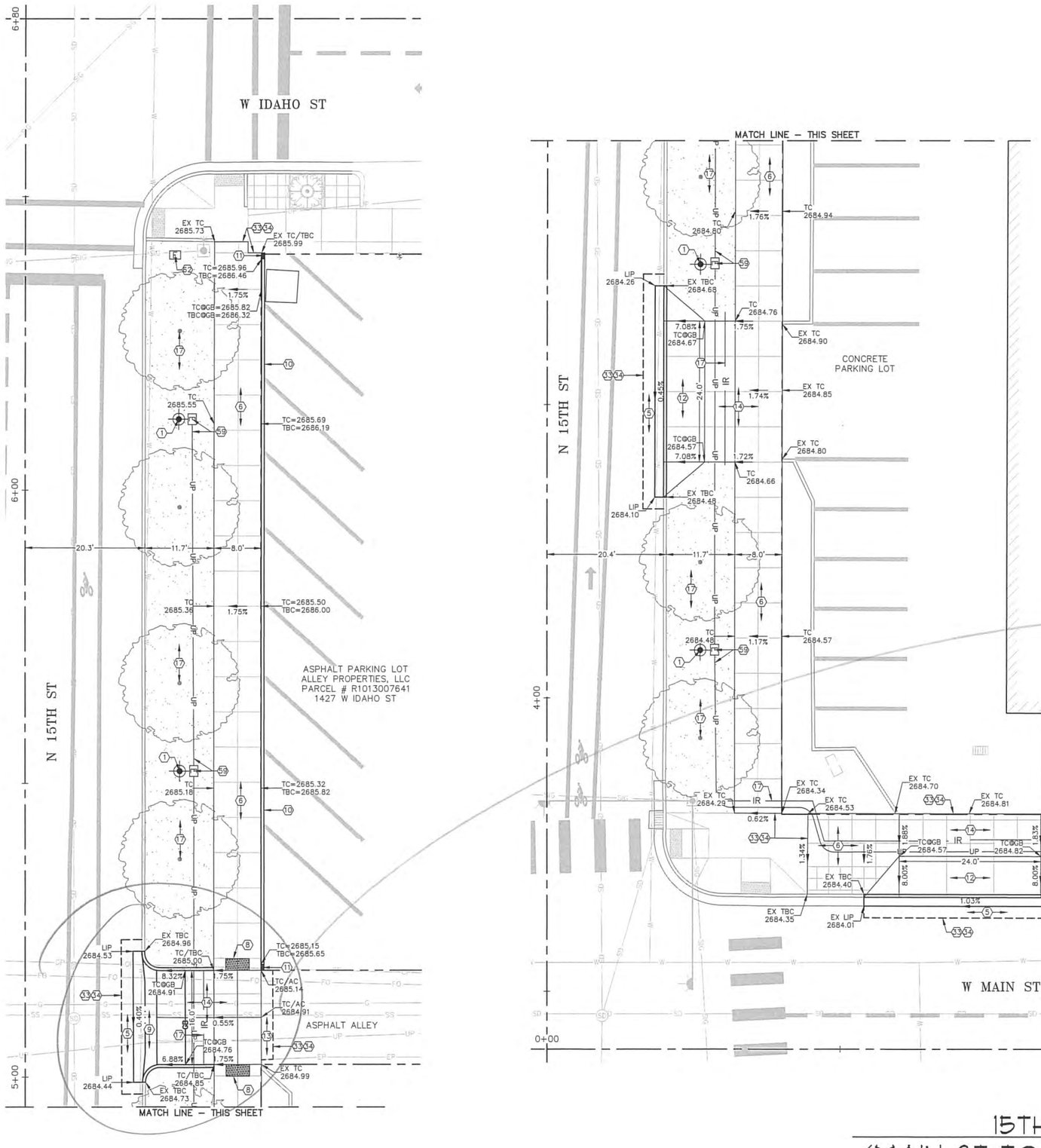
Scale	As Sh

Sheet Title
DEMOLITIC PLAN

Sheet Number
C-7
Of Sheet



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Issue	Description
PERMIT	
BID SET	

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5/22/15

JENSENBELL ASSOCIATES
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e-mail: jba@jensenbell.com

GRAPHIC SCALE
0 10 20
(IN FEET)
1 INCH = 10 FT.

KEYNOTES

(1) HISTORIC STREET LIGHT, SEE ELECTRICAL PLANS
(3) TREE WELL, SEE STREETSCAPE PLANS
(4) SEE SILVA CELLS PLANS
(5) ASPHALT PAVING, SEE DETAIL 1/C-2
(6) CONCRETE SIDEWALK PER ACHD SUPPLEMENTAL TO ISPWC SD-709
(8) MUTUAL MATERIALS (OR ENGINEER APPROVED EQUIVALENT) TRAFFIC YELLOW DETECTABLE WARNING DOMES PER ISPWC SD-712
(9) VALLEY GUTTER PER ACHD SUPPLEMENT TO ISPWC SD-708
(10) 6" VERTICAL CURB (NO GUTTER) PER ISPWC SD-701A
(11) 1' CURB TERMINUS
(12) CONCRETE DRIVEWAY APPROACH PER ACHD SUPPLEMENT TO ISPWC SD-710
(13) TYPE P ASPHALT REPAIR PER ACHD SUPPLEMENT TO ISPWC SD-303
(14) CONCRETE DRIVEWAY, CONCRETE AND BASE COURSE THICKNESS PER ACHD SUPPLEMENT TO ISPWC SD-710
(17) SEE STREETSCAPE PLANS
(25) RE-SET STREET SIGN SALVAGED DURING DEMOLITION, INSTALL NEW SIGN BASE PER BOISE CITY PARKING STANDARDS
(33) MATCH EXISTING
(34) WORK LIMITS
(53) INSTALL SOD AS NECESSARY TO REPAIR EXPOSED SOIL FROM SIDEWALK DEMOLITION
(59) UNDERGROUND POWER/PULL BOX, BACKFILL AND BEDDING PER ISPWC SD-301, SEE ELECTRICAL PLANS
(62) REPLACE EXISTING JUNCTION BOX WITH IDAHO PRECAST S-40T OR APPROVED EQUAL

4" WIDE 2-3" THICK VG SPEC CALLS OUT 8" THICK
CONFLICT W/ UNEARTHED UTILITY POWER PIPE – CANNOT ACHIEVE 8" THICK VG –
– OPTION TO ELIMINATE CONCRETE ENCASED UTILITY
DESIGN ASPHALT VG (AS WHAT WAS THERE ORIGINALLY)
– CAN USE A THIN CONC SET PRODUCT – MUST PROVIDE SPECS IT WILL SUPPORT TRUCK TRAFFIC –

Plans Are Accepted For Public Street Construction

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BY _____ DATE 5-29-15
ADA COUNTY HIGHWAY DISTRICT

15TH & MAIN STREET
(MAIN ST TO IDAHO ST - EAST SIDES)

2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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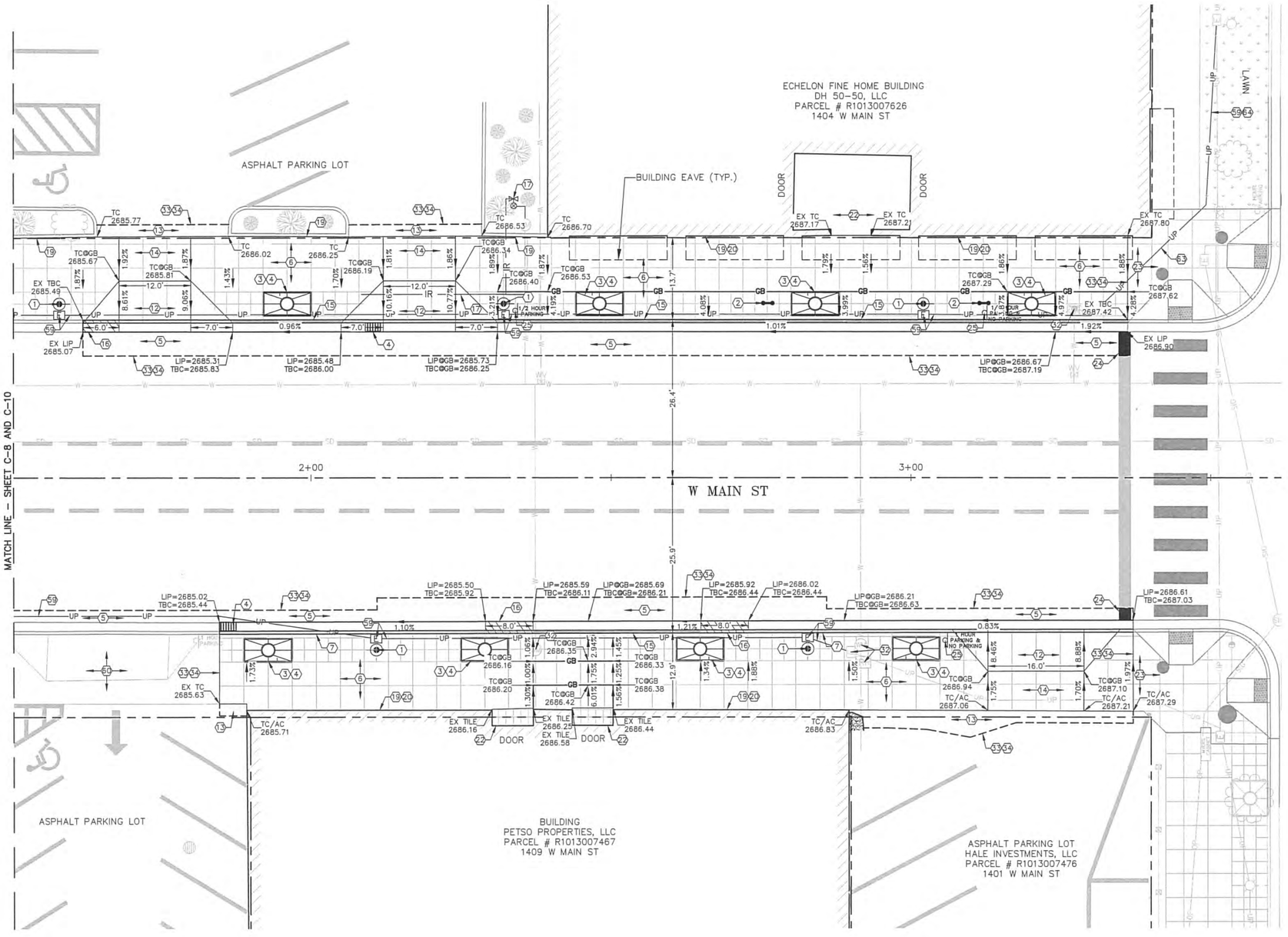
Sheet Title
SITE CIVIL PLAN

Sheet Number
C-8
Of Sheet





KEYNOTES

(1) HISTORIC STREET LIGHT, SEE ELECTRICAL PLANS
(2) BIKE RACK, SEE STREETSCAPE PLANS
(3) TREE WELL, SEE STREETSCAPE PLANS
(4) SEE SILVA CELLS PLANS
(5) ASPHALT PAVING, SEE DETAIL 1/C-2
(6) CONCRETE SIDEWALK PER ACHD SUPPLEMENTAL TO ISPWC SD-709
(7) 6" VERTICAL CURB AND GUTTER PER ACHD SUPPLEMENT TO ISPWC SD-701
(12) CONCRETE DRIVEWAY APPROACH PER ACHD SUPPLEMENT TO ISPWC SD-710
(13) TYPE P ASPHALT REPAIR PER ACHD SUPPLEMENT TO ISPWC SD-303
(14) CONCRETE DRIVEWAY, CONCRETE AND BASE COURSE THICKNESS PER ACHD SUPPLEMENT TO ISPWC SD-710
(15) 7" VERTICAL CURB AND GUTTER, SEE DETAIL 2/C-2
(16) TRANSITION FROM 6" VERTICAL CURB TO 7" VERTICAL CURB, TRANSITION AT TOP BACK OF CURB
(17) SEE STREETSCAPE PLANS
(19) ½" BITUMINOUS PREFORMED EXPANSION JOINT MATERIAL (AASHTO M 213) AT BUILDING FACE/BUILDING FACE WITH POLYURETHANE SEALANT (TREMCO THC-901, OR APPROVED EQUAL)
(20) TOUCH UP DAMAGED PAINT AT BUILDING AND/OR PAINT NEWLY EXPOSED CONCRETE ON BUILDING WALL (MATCH EXISTING COLOR)
(22) CONTRACTOR SHALL MAINTAIN ACCESS TO BUSINESS THROUGH SECOND ENTRANCE DURING CONSTRUCTION IN FRONT OF DOOR WAY, PROVIDE SIGNS AS NECESSARY TO DIRECT CUSTOMERS TO SECOND ENTRANCE
(23) SIDEWALK BY ACHD
(24) REPAIR STOP BAR/CROSSWALK/PARKING STRIPING
(25) RE-SET STREET SIGN SALVAGED DURING DEMOLITION, INSTALL NEW SIGN BASE PER BOISE CITY PARKING STANDARDS
(32) ADJUST TO FINISHED GRADE
(33) MATCH EXISTING
(34) WORK LIMITS
(59) UNDERGROUND POWER/PULL BOX, BACKFILL AND BEDDING PER ISPWC SD-301, SEE ELECTRICAL PLANS
(60) CONTRACTOR SHALL MAINTAIN ACCESS TO PARKING LOT THROUGH DRIVEWAY, DURING IDAHO YOUTH RANCH BUSINESS HOURS
(63) INSTALL UNDERGROUND POWER THROUGH EXISTING CONDUIT UNDER SIDEWALK
(64) REPAIR SOD AND IRRIGATION LINES DAMAGED DURING UNDERGROUND POWER INSTALLATION

MAIN STREET - EAST END
(15TH ST TO 14TH ST)

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BY _____ DATE 5-29-15
ADA COUNTY HIGHWAY DISTRICT

Quadrant Consulting, Inc.
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CIVIL ENGINEERING-SURVEYING

Issue	Description
PERMIT	
BID SET	

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
5/22/15

JENSENBELT ASSOCI
Site Planning
Landscape Architectur
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2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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Sheet Title
SITE CIVIL PLAN

Sheet Number
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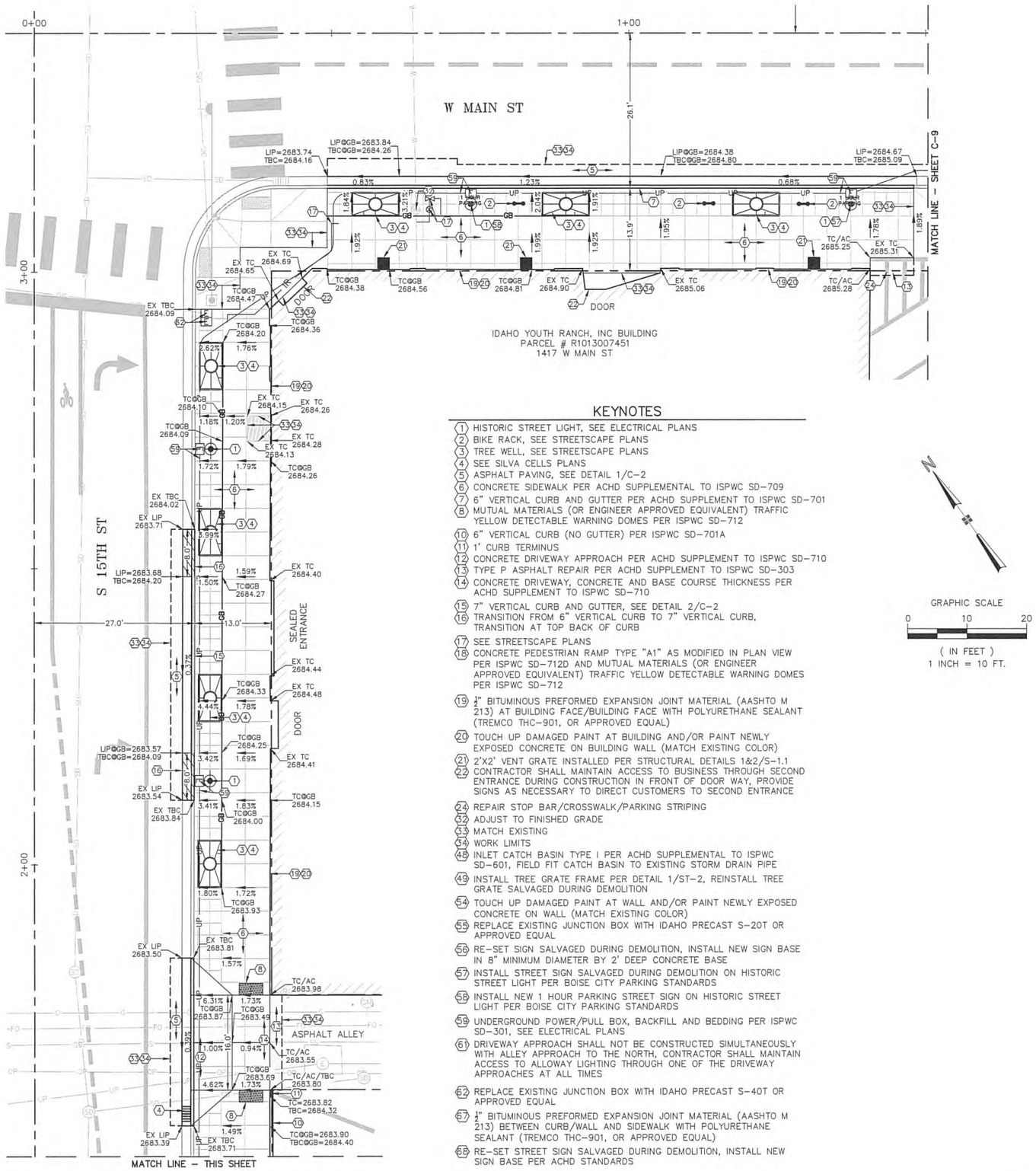

KEYNOTES

(1) HISTORIC STREET LIGHT, SEE ELECTRICAL PLANS
(2) BIKE RACK, SEE STREETSCAPE PLANS
(3) TREE WELL, SEE STREETSCAPE PLANS
(4) SEE SILVA CELLS PLANS
(5) ASPHALT PAVING, SEE DETAIL 1/C-2
(6) CONCRETE SIDEWALK PER ACHD SUPPLEMENTAL TO ISPWC SD-709
(7) 6" VERTICAL CURB AND GUTTER PER ACHD SUPPLEMENT TO ISPWC SD-701
(8) MUTUAL MATERIALS (OR ENGINEER APPROVED EQUIVALENT) TRAFFIC YELLOW DETECTABLE WARNING DOMES PER ISPWC SD-712
(10) 6" VERTICAL CURB (NO GUTTER) PER ISPWC SD-701A
(11) 1' CURB TERMINUS
(12) CONCRETE DRIVEWAY APPROACH PER ACHD SUPPLEMENT TO ISPWC SD-710
(13) TYPE P ASPHALT REPAIR PER ACHD SUPPLEMENT TO ISPWC SD-303
(14) CONCRETE DRIVEWAY, CONCRETE AND BASE COURSE THICKNESS PER ACHD SUPPLEMENT TO ISPWC SD-710
(15) 7" VERTICAL CURB AND GUTTER, SEE DETAIL 2/C-2
(16) TRANSITION FROM 6" VERTICAL CURB TO 7" VERTICAL CURB, TRANSITION AT TOP BACK OF CURB
(17) SEE STREETSCAPE PLANS
(18) CONCRETE PEDESTRIAN RAMP TYPE "A1" AS MODIFIED IN PLAN VIEW PER ISPWC SD-712D AND MUTUAL MATERIALS (OR ENGINEER APPROVED EQUIVALENT) TRAFFIC YELLOW DETECTABLE WARNING DOMES PER ISPWC SD-712
(19) ½" BITUMINOUS PREFORMED EXPANSION JOINT MATERIAL (AASHTO M 213) AT BUILDING FACE/BUILDING FACE WITH POLYURETHANE SEALANT (TREMCO THC-901, OR APPROVED EQUAL)
(20) TOUCH UP DAMAGED PAINT AT BUILDING AND/OR PAINT NEWLY EXPOSED CONCRETE ON BUILDING WALL (MATCH EXISTING COLOR)
(21) 2'X2' VENT GRATE INSTALLED PER STRUCTURAL DETAILS 1&2/S-1.1
(22) CONTRACTOR SHALL MAINTAIN ACCESS TO BUSINESS THROUGH SECOND ENTRANCE DURING CONSTRUCTION IN FRONT OF DOOR WAY, PROVIDE SIGNS AS NECESSARY TO DIRECT CUSTOMERS TO SECOND ENTRANCE
(24) REPAIR STOP BAR/CROSSWALK/PARKING STRIPING
(32) ADJUST TO FINISHED GRADE
(33) MATCH EXISTING
(34) WORK LIMITS
(48) INLET CATCH BASIN TYPE I PER ACHD SUPPLEMENTAL TO ISPWC SD-601, FIELD FIT CATCH BASIN TO EXISTING STORM DRAIN PIPE
(49) INSTALL TREE GRATE FRAME PER DETAIL 1/ST-2, REINSTALL TREE GRATE SALVAGED DURING DEMOLITION
(54) TOUCH UP DAMAGED PAINT AT WALL AND/OR PAINT NEWLY EXPOSED CONCRETE ON WALL (MATCH EXISTING COLOR)
(55) REPLACE EXISTING JUNCTION BOX WITH IDAHO PRECAST S-20T OR APPROVED EQUAL
(56) RE-SET SIGN SALVAGED DURING DEMOLITION, INSTALL NEW SIGN BASE IN 8" MINIMUM DIAMETER BY 2' DEEP CONCRETE BASE
(57) INSTALL STREET SIGN SALVAGED DURING DEMOLITION ON HISTORIC STREET LIGHT PER BOISE CITY PARKING STANDARDS
(58) INSTALL NEW 1 HOUR PARKING STREET SIGN ON HISTORIC STREET LIGHT PER BOISE CITY PARKING STANDARDS
(59) UNDERGROUND POWER/PULL BOX, BACKFILL AND BEDDING PER ISPWC SD-301, SEE ELECTRICAL PLANS
(61) DRIVEWAY APPROACH SHALL NOT BE CONSTRUCTED SIMULTANEOUSLY WITH ALLEY APPROACH TO THE NORTH, CONTRACTOR SHALL MAINTAIN ACCESS TO ALLOWAY LIGHTING THROUGH ONE OF THE DRIVEWAY APPROACHES AT ALL TIMES
(62) REPLACE EXISTING JUNCTION BOX WITH IDAHO PRECAST S-40T OR APPROVED EQUAL
(67) ½" BITUMINOUS PREFORMED EXPANSION JOINT MATERIAL (AASHTO M 213) BETWEEN CURB/WALL AND SIDEWALK WITH POLYURETHANE SEALANT (TREMCO THC-901, OR APPROVED EQUAL)
(68) RE-SET STREET SIGN SALVAGED DURING DEMOLITION, INSTALL NEW SIGN BASE PER ACHD STANDARDS

GRAPHIC SCALE
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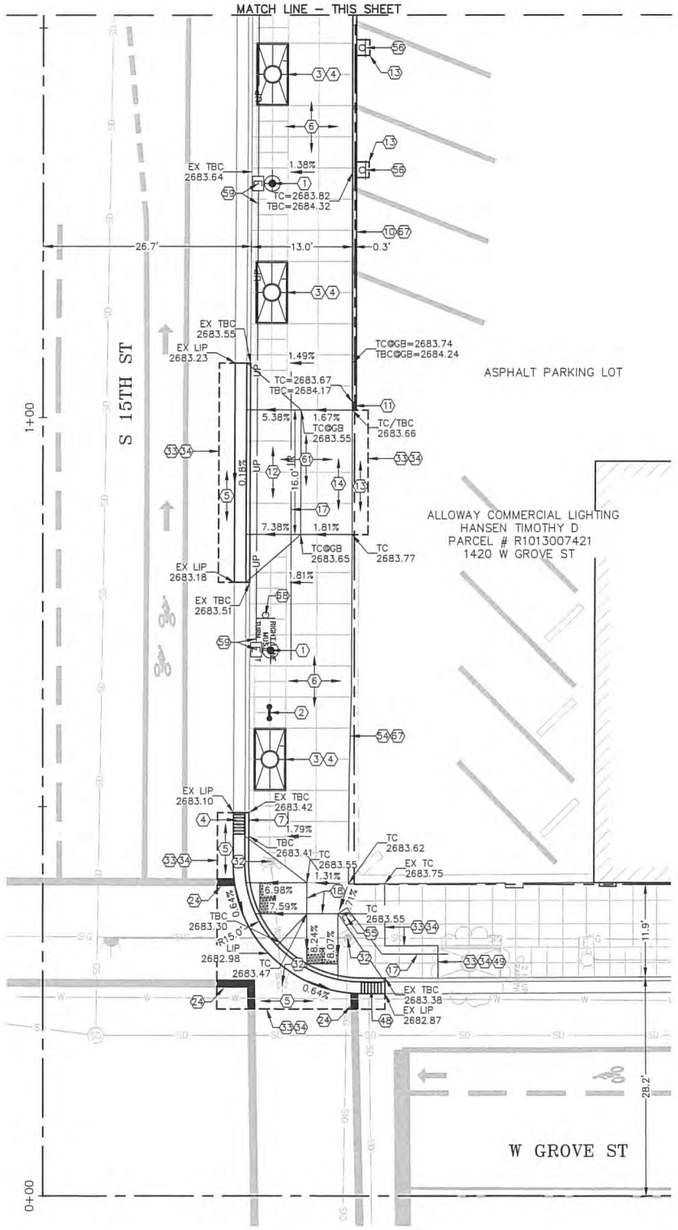
(IN FEET)
1 INCH = 10 FT.



15TH & MAIN STREET
(MAIN ST TO GROVE ST - EAST SIDE)

Plans Are Accepted For Public Street Construction

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BY _____ DATE: 5-29-15
ADA COUNTY HIGHWAY DISTRICT

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue	
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BID SET	S

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA 5/22/15

JENSENBELL ASSOCIATES
Site Planning
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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO

Job Number: 20

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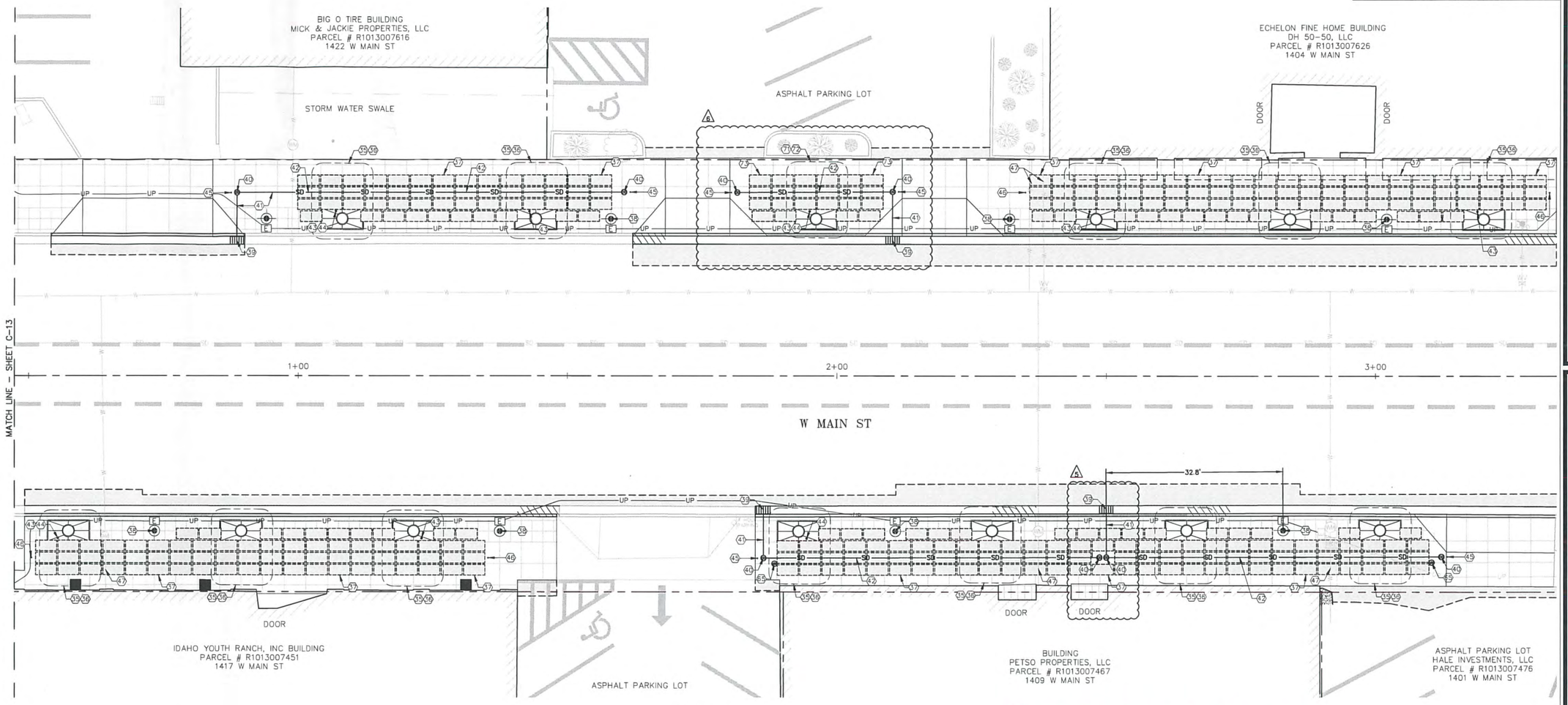
Scale	As Sh

Sheet Title
SITE CIVIL PLAN

Sheet Number
C-10

Of Sheet



KEYNOTES

35. SILVA CELLS INSTALLED PER DETAIL 1/C-3
36. SILVA CELLS INSTALLED PER DETAIL 2/C-3
37. SILVA CELLS INSTALLED PER DETAIL 3/C-3
38. SILVA CELLS INSTALLATION AROUND LIGHT POLE BASE PER DETAIL 4/C-3
39. INLET CATCH BASIN PER DETAIL 3/C-2
40. CLEAN-OUT PER DETAIL 4/C-2
41. 6" SOLID WALL SDR 35 PVC PIPE
42. 6" PERFORATED SDR 35 PVC PIPE
43. SILVA CELL INSPECTION RISER PER DETAIL 1/C-3
44. FINDER WIRE PER DETAIL 1/C-3
45. STORM DRAIN MONUMENT PER ISPWC SD-623, MONUMENT SHALL READ "UNDERGROUND STORM DRAIN CONTACT ACHD", DRILL HOLE IN BRICK/CONCRETE AND EPOXY MONUMENT TO SIDEWALK
46. STORM DRAIN MONUMENT PER ISPWC SD-623, MONUMENT SHALL READ "UNDERGROUND SILVA CELL SYSTEM CONTACT ACHD", DRILL HOLE IN BRICK/CONCRETE AND EPOXY MONUMENT TO SIDEWALK
47. INSTALL NEW POLYETHYLENE (PE 3408 PER ASTMD 3350) SERVICE LINE THROUGH/UNDER SILVA CELL LAYOUT, SUPPORT UTILITY LINE PER DETAIL 5/C-2, NEW SERVICE LINE SHALL MATCH EXISTING LINE SIZE, CONTRACTOR TO PROVIDE NECESSARY FITTINGS FOR INSTALLATION
65. MONITORING WELL PER DETAIL 5/C-3
71. SILVA CELLS INSTALLED PER DETAIL 1/C-3.1
72. SILVA CELLS INSTALLED PER DETAIL 2/C-3.1
73. SILVA CELLS INSTALLED PER DETAIL 3/C-3.1

GRAPHIC SCALE
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BY _____ DATE 10.9.15
ADA COUNTY HIGHWAY DISTRICT

MAIN STREET
(15TH ST TO 14TH ST)

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue Description	Date
PERMIT	4/6/14
BID SET	5/27/15
5 DESIGN REVISION #5	10/7/15
6 DESIGN REVISION #6	10/7/15

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
10/7/2015

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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 204-21

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Scale	As Shown

Sheet Title: SILVA CELL PLAN

Sheet Number: C-12
Of Sheets

Quadrant Consulting, Inc.
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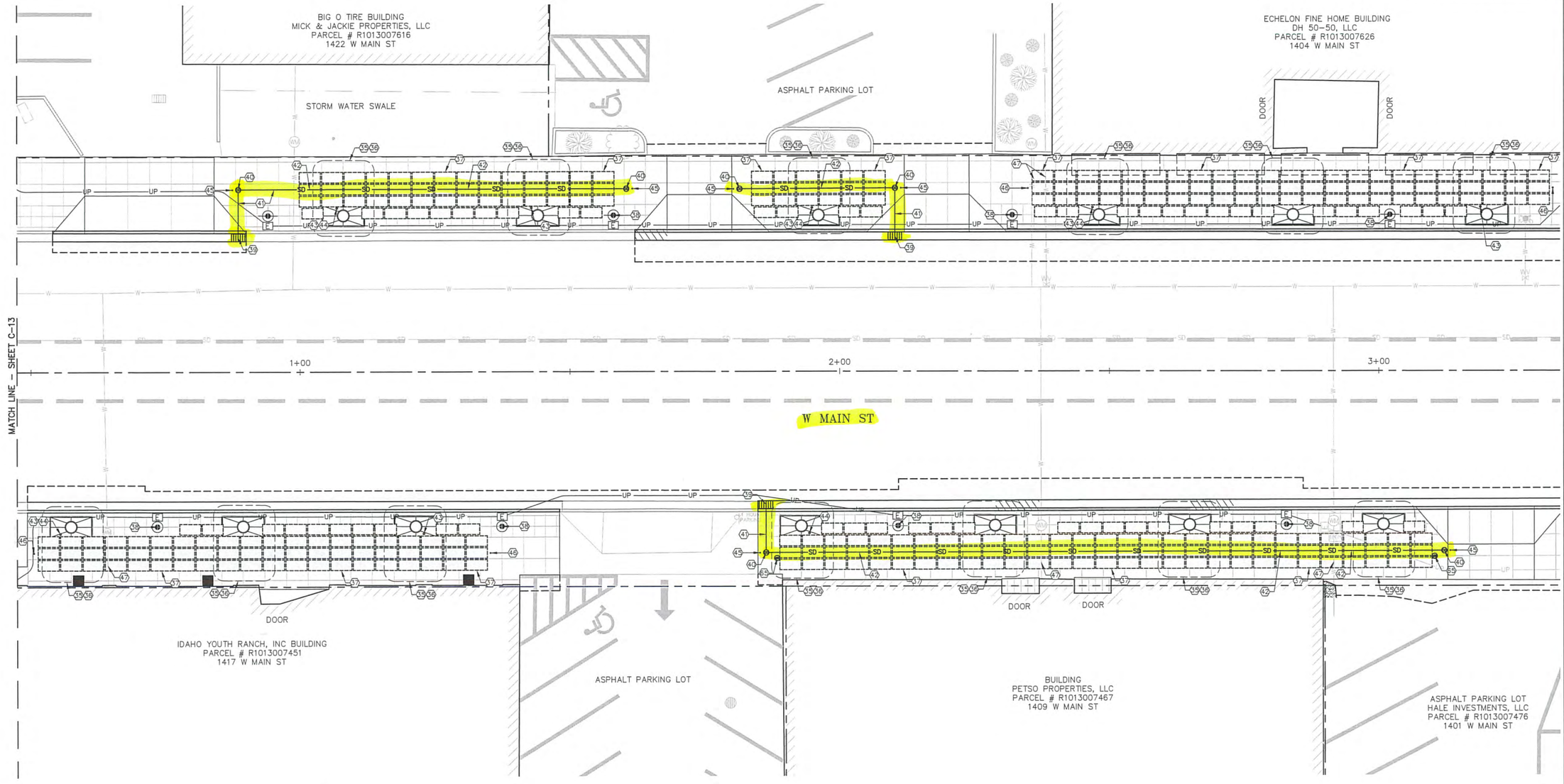
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue Description	Date
PERMIT	4/6/14
BID SET	5/27/15



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KEYNOTES

35 SILVA CELLS INSTALLED PER DETAIL 1/C-3
36 SILVA CELLS INSTALLED PER DETAIL 2/C-3
37 SILVA CELLS INSTALLED PER DETAIL 3/C-3
38 SILVA CELLS INSTALLATION AROUND LIGHT POLE BASE PER DETAIL 4/C-3
39 INLET CATCH BASIN PER DETAIL 3/C-2
40 CLEAN-OUT PER DETAIL 4/C-2
41 6" SOLID WALL SDR 35 PVC PIPE
42 6" PERFORATED SDR 35 PVC PIPE
43 SILVA CELL INSPECTION RISER PER DETAIL 1/C-3
44 FINDER WIRE PER DETAIL 1/C-3
45 STORM DRAIN MONUMENT PER ISPWC SD-623, MONUMENT SHALL READ "UNDERGROUND STORM DRAIN CONTACT ACHD", DRILL HOLE IN BRICK/CONCRETE AND EPOXY MONUMENT TO SIDEWALK
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47 SUPPORT UTILITY LINE PER DETAIL 5/C-2
65 MONITORING WELL PER DETAIL 5/C-3

MAIN STREET
(15TH ST TO 14TH ST)

Plans Are Accepted For Public Street Construction

By stamping and signing the improvement plans, the Registered Engineer ensures the District that the plans conform to all District policies and standards. Variances or waivers must be specifically and previously approved by the District in writing. Acceptance of the improvement plans by the District does not relieve the Registered Engineer of these responsibilities.

BY _____ DATE: 5.29.15
ADA COUNTY HIGHWAY DISTRICT

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA 5/22/15

JENSENBELTS ASSOCIATES
Site Planning
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Boise, Idaho 83702
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Fax (208) 343-7178
e-mail: jba@jensenbelts.com

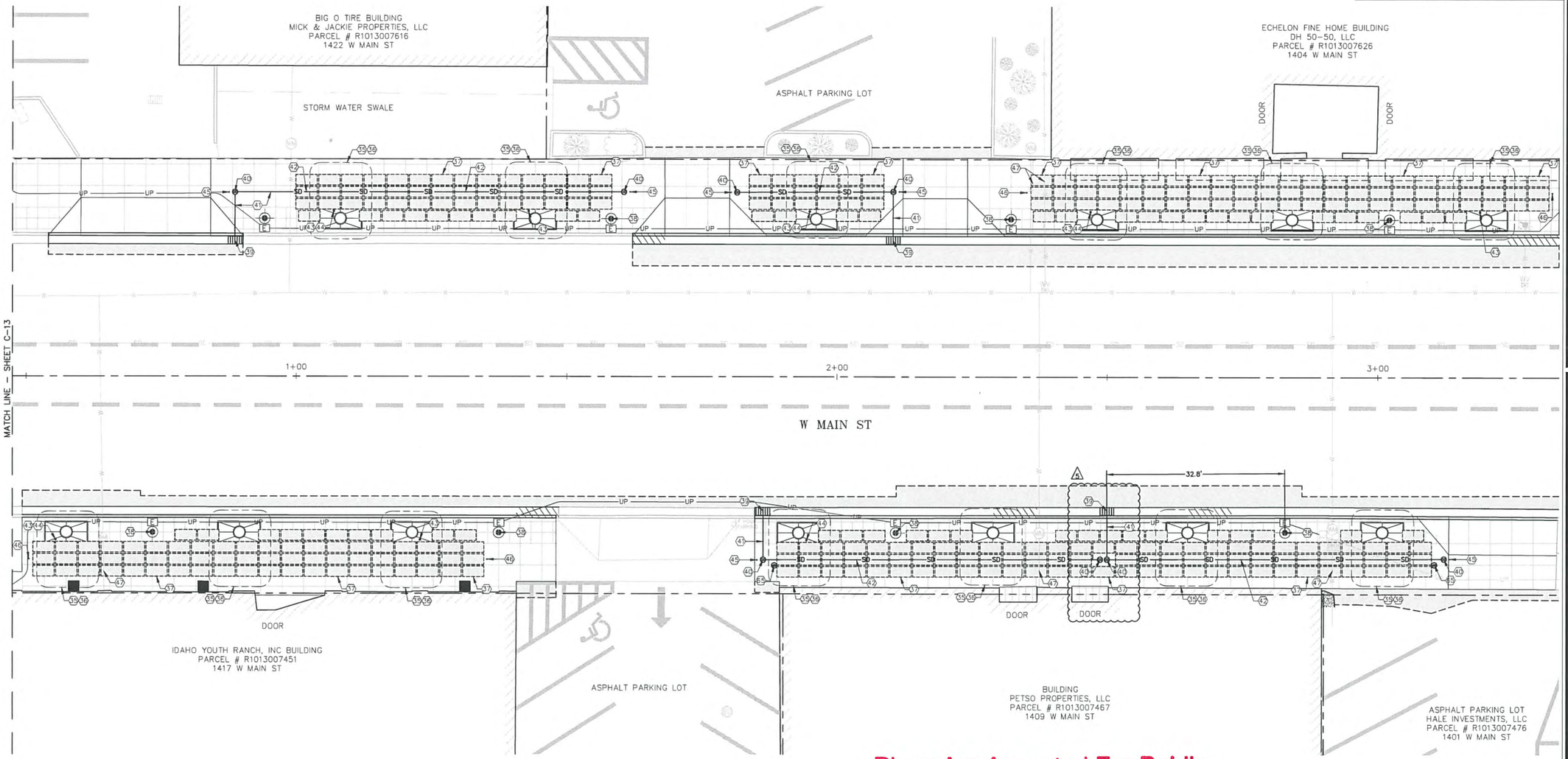
2015 WESTSIDE DISTRICT
DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 204-21

Drawn	Checked
RZ	RZ
Scale	As Shown

Sheet Title
SILVA CELL PLAN

Sheet Number
C-12
Of Sheets





KEYNOTES

35 SILVA CELLS INSTALLED PER DETAIL 1/C-3
36 SILVA CELLS INSTALLED PER DETAIL 2/C-3
37 SILVA CELLS INSTALLED PER DETAIL 3/C-3
38 SILVA CELLS INSTALLATION AROUND LIGHT POLE BASE PER DETAIL 4/C-3
39 INLET CATCH BASIN PER DETAIL 3/C-2
40 CLEAN-OUT PER DETAIL 4/C-2
41 6" SOLID WALL SDR 35 PVC PIPE
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BY: _____ DATE: 10.7.15
ADA COUNTY HIGHWAY DISTRICT

MAIN STREET
(15TH ST TO 14TH ST)

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
(208) 342-0091 PHONE (208) 342-0092 FAX
CIVIL ENGINEERING-SURVEYING

Issue Description	Date
PERMIT	4/6/14
BID SET	5/27/15
5 DESIGN REVISION #5	10/7/15

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
10/7/2015

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BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 204-21

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Sheet Title: SILVA CELL PLAN

Sheet Number: C-12
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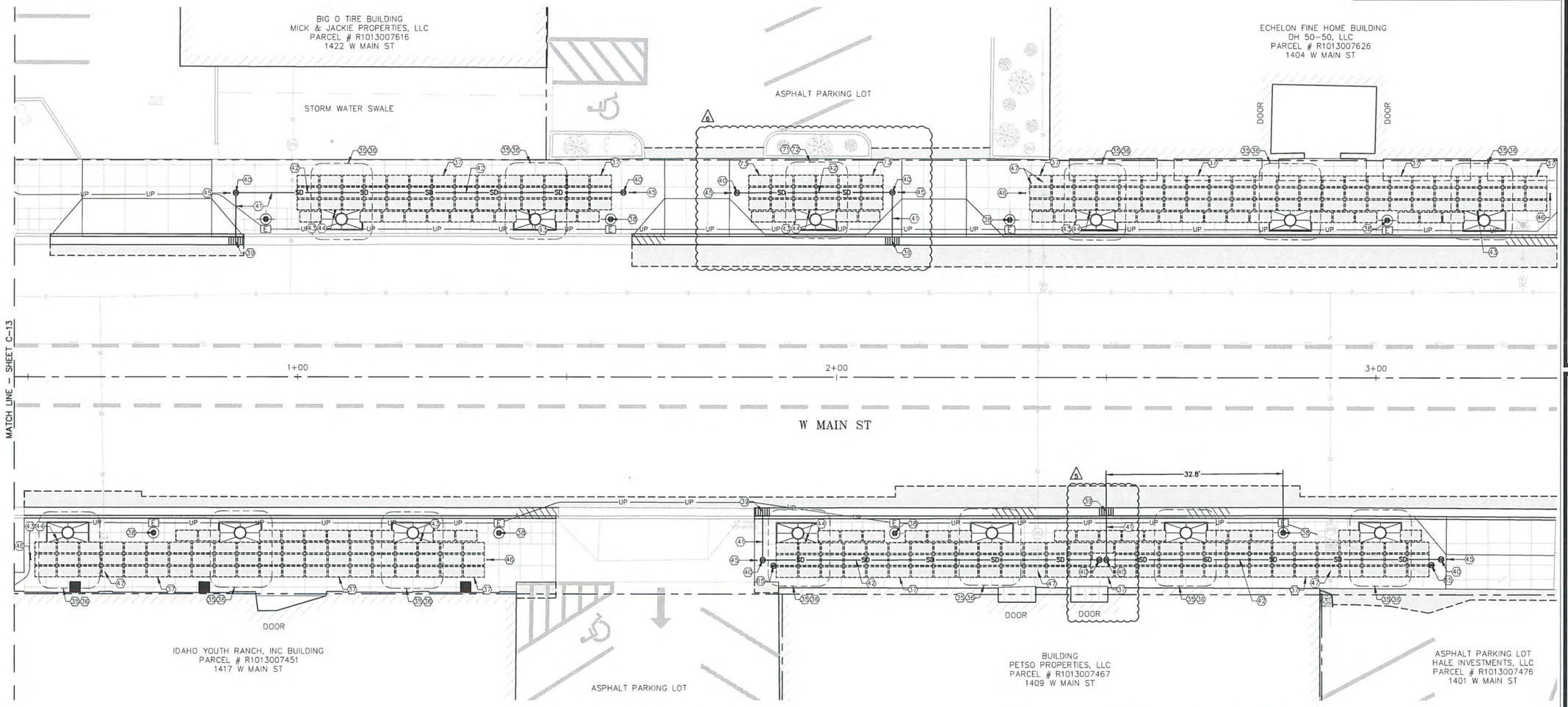

GRAPHIC SCALE

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KEYNOTES

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65 MONITORING WELL PER DETAIL 5/C-3
71 SILVA CELLS INSTALLED PER DETAIL 1/C-3.1
72 SILVA CELLS INSTALLED PER DETAIL 2/C-3.1
73 SILVA CELLS INSTALLED PER DETAIL 3/C-3.1

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BY _____ DATE 10.9.15
ADA COUNTY HIGHWAY DISTRICT

MAIN STREET
(15TH ST TO 14TH ST)

Quadrant Consulting, Inc.
1904 W. Overland Rd
Boise, Idaho 83705
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CIVIL ENGINEERING-SURVEYING

Issue Description	Date
PERMIT	4/6/14
BID SET	5/27/15
5 DESIGN REVISION #5	10/7/15
6 DESIGN REVISION #6	10/7/15

PROFESSIONAL ENGINEER LICENSED 15180 Ricardo Zavala STATE OF IDAHO RICARDO ZAVALA
10/7/2015

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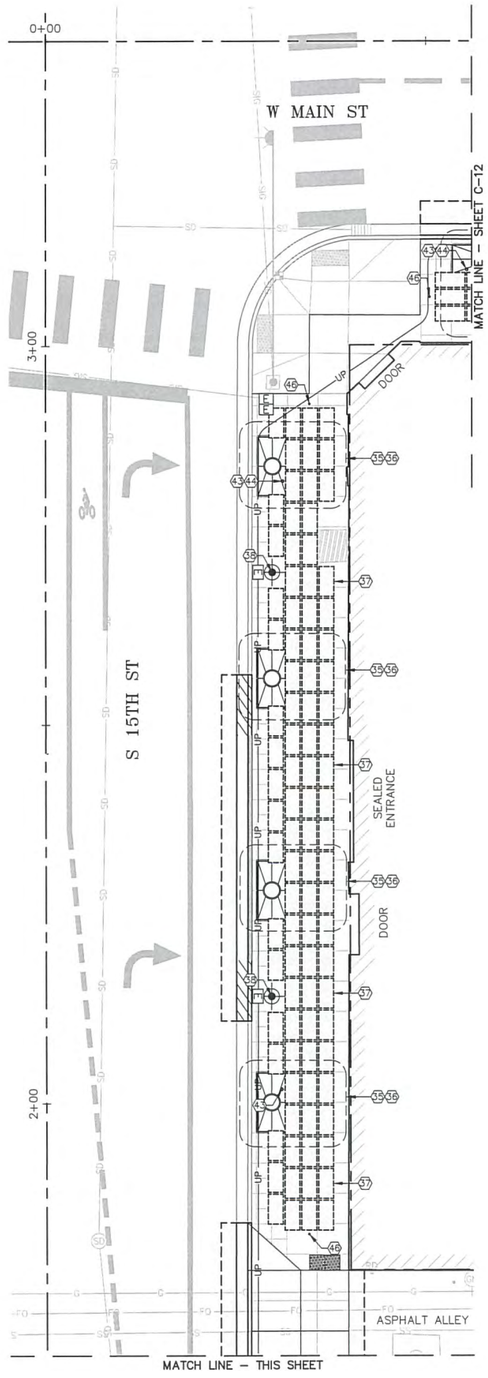

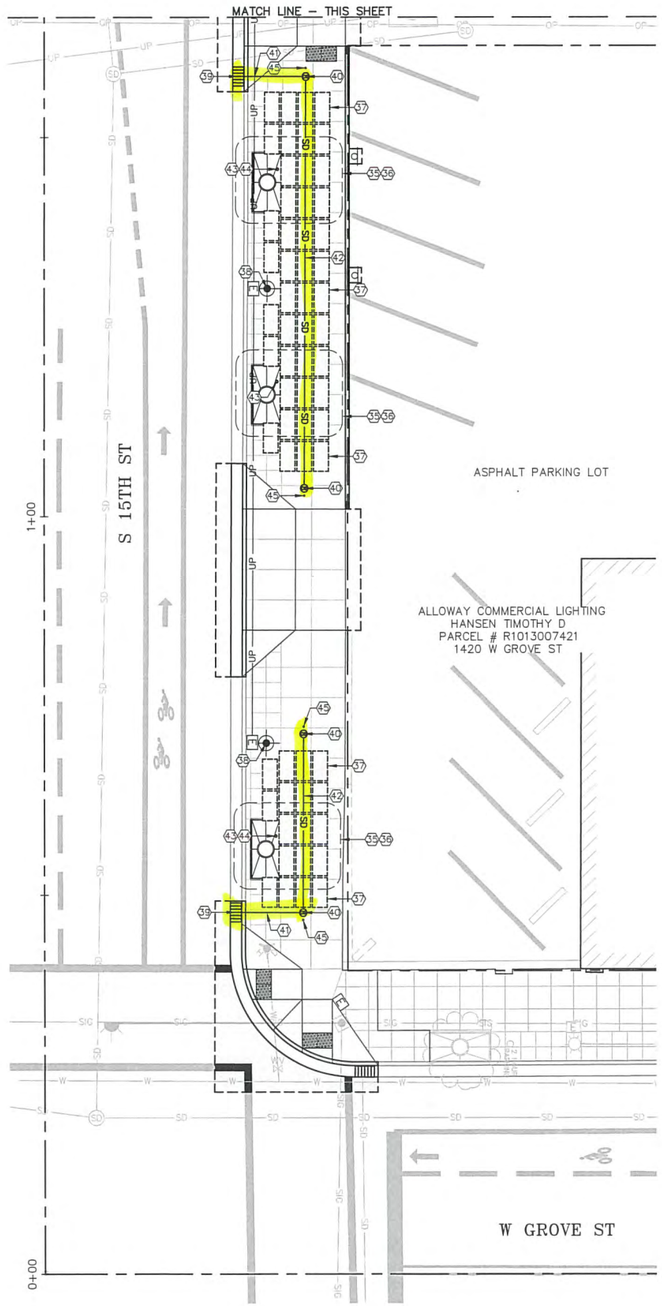

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CIVIL ENGINEERING–SURVEYING

Issue Description	Date
PERMIT	4/8/14
BID SET	5/27/15

PROFESSIONAL ENGINEER LICENSED 15180 RICARDO ZAVALA STATE OF IDAHO
5/22/15

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GRAPHIC SCALE
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KEYNOTES

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15TH STREET
(MAIN ST TO GROVE ST - EAST SIDE)

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BY: _____ DATE: 5.29.15
ADA COUNTY HIGHWAY DISTRICT

2015 WESTSIDE DISTRICT DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

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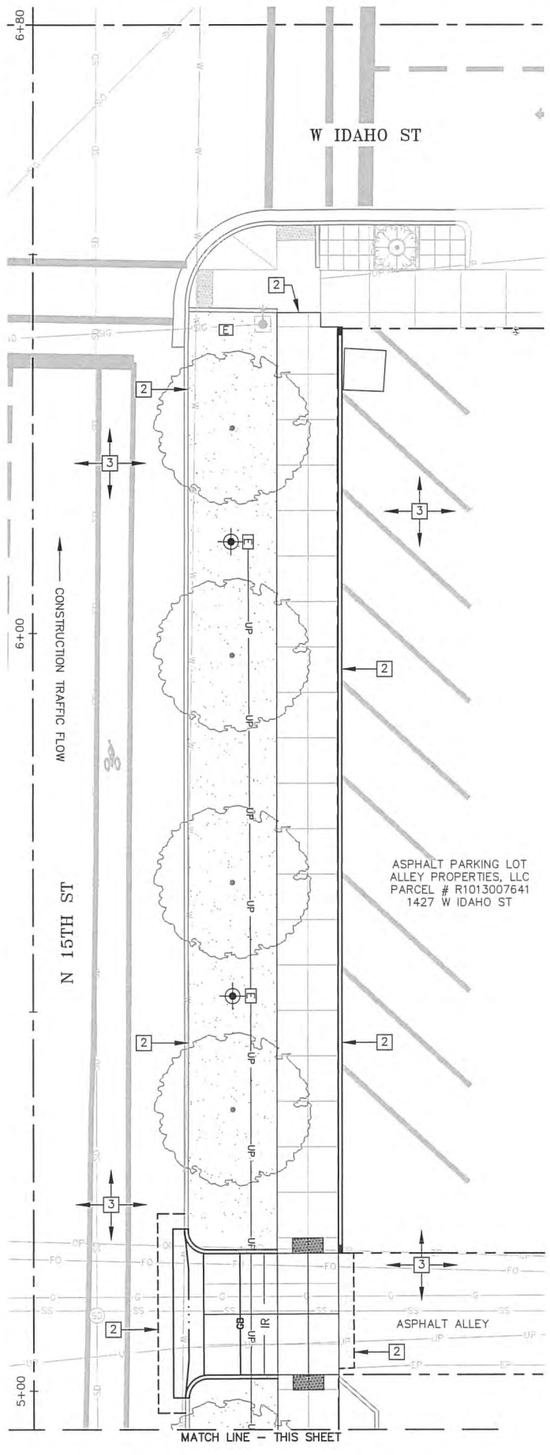
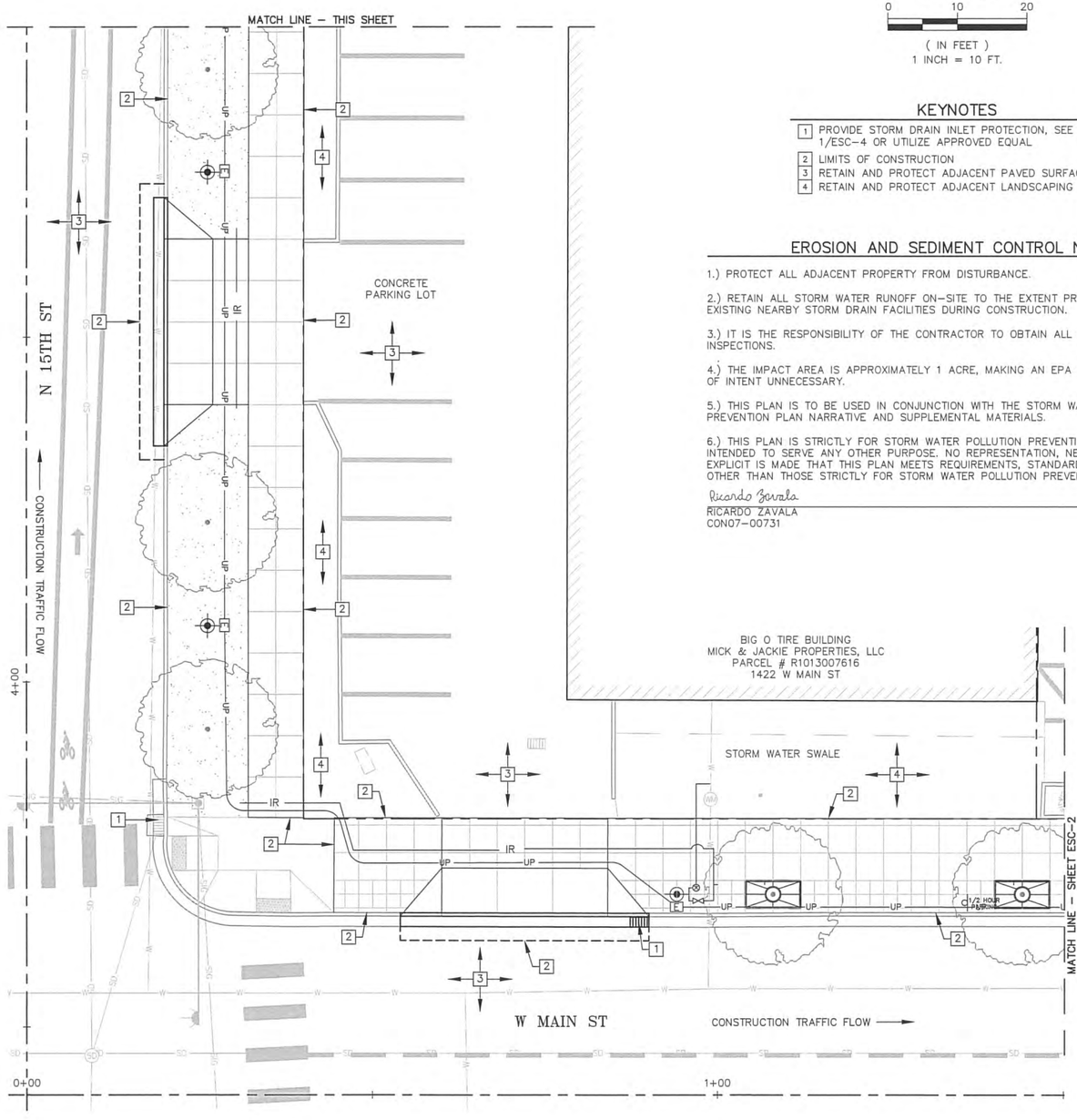
Sheet Title
SILVA CELL PLAN

Sheet Number
C-13
Of Sheets







GRAPHIC SCALE

0 10 20

(IN FEET)
1 INCH = 10 FT.

KEYNOTES

1. PROVIDE STORM DRAIN INLET PROTECTION, SEE DETAIL 1/ESC–4 OR UTILIZE APPROVED EQUAL
2. LIMITS OF CONSTRUCTION
3. RETAIN AND PROTECT ADJACENT PAVED SURFACES
4. RETAIN AND PROTECT ADJACENT LANDSCAPING

EROSION AND SEDIMENT CONTROL NOTES

1.) PROTECT ALL ADJACENT PROPERTY FROM DISTURBANCE.

2.) RETAIN ALL STORM WATER RUNOFF ON–SITE TO THE EXTENT PRACTICAL. PROTECT EXISTING NEARBY STORM DRAIN FACILITIES DURING CONSTRUCTION.

3.) IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ALL REQUIRED PERMITS AND INSPECTIONS.

4.) THE IMPACT AREA IS APPROXIMATELY 1 ACRE, MAKING AN EPA STORM WATER NOTICE OF INTENT UNNECESSARY.

5.) THIS PLAN IS TO BE USED IN CONJUNCTION WITH THE STORM WATER POLLUTION PREVENTION PLAN NARRATIVE AND SUPPLEMENTAL MATERIALS.

6.) THIS PLAN IS STRICTLY FOR STORM WATER POLLUTION PREVENTION AND IS NOT INTENDED TO SERVE ANY OTHER PURPOSE. NO REPRESENTATION, NEITHER IMPLICIT OR EXPLICIT IS MADE THAT THIS PLAN MEETS REQUIREMENTS, STANDARDS, OR SPECIFICATIONS OTHER THAN THOSE STRICTLY FOR STORM WATER POLLUTION PREVENTION.

Ricardo Zavala — 5/22/15
RICARDO ZAVALA — DATE
CON07–00731

15TH & MAIN STREET
(MAIN ST TO IDAHO ST - EAST SIDES)

Quadrant Consulting, Inc.
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CIVIL ENGINEERING–SURVEYING

Issue Description	Date
PERMIT	4/6/14
BID SET	5/27/15

JENSENBELTS ASSOCIATES
Site Planning
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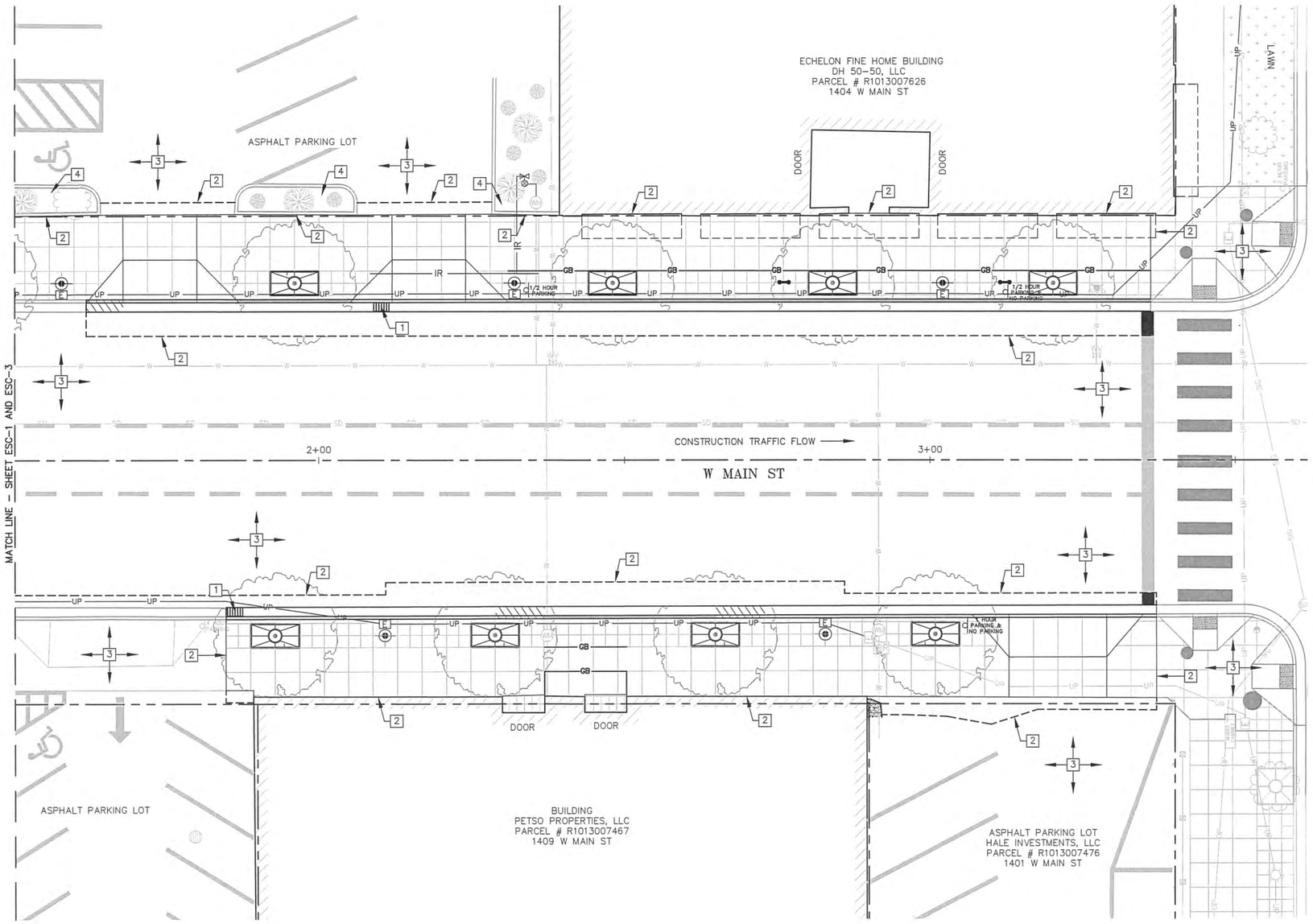
Sheet Title
EROSION AND SEDIMENT CONTROL PLAN

Sheet Number
ESC–1
Of Sheets



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2. LIMITS OF CONSTRUCTION
3. RETAIN AND PROTECT ADJACENT PAVED SURFACES
4. RETAIN AND PROTECT ADJACENT LANDSCAPING

MAIN STREET - EAST END
(15TH ST TO 14TH ST)

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CIVIL ENGINEERING-SURVEYING

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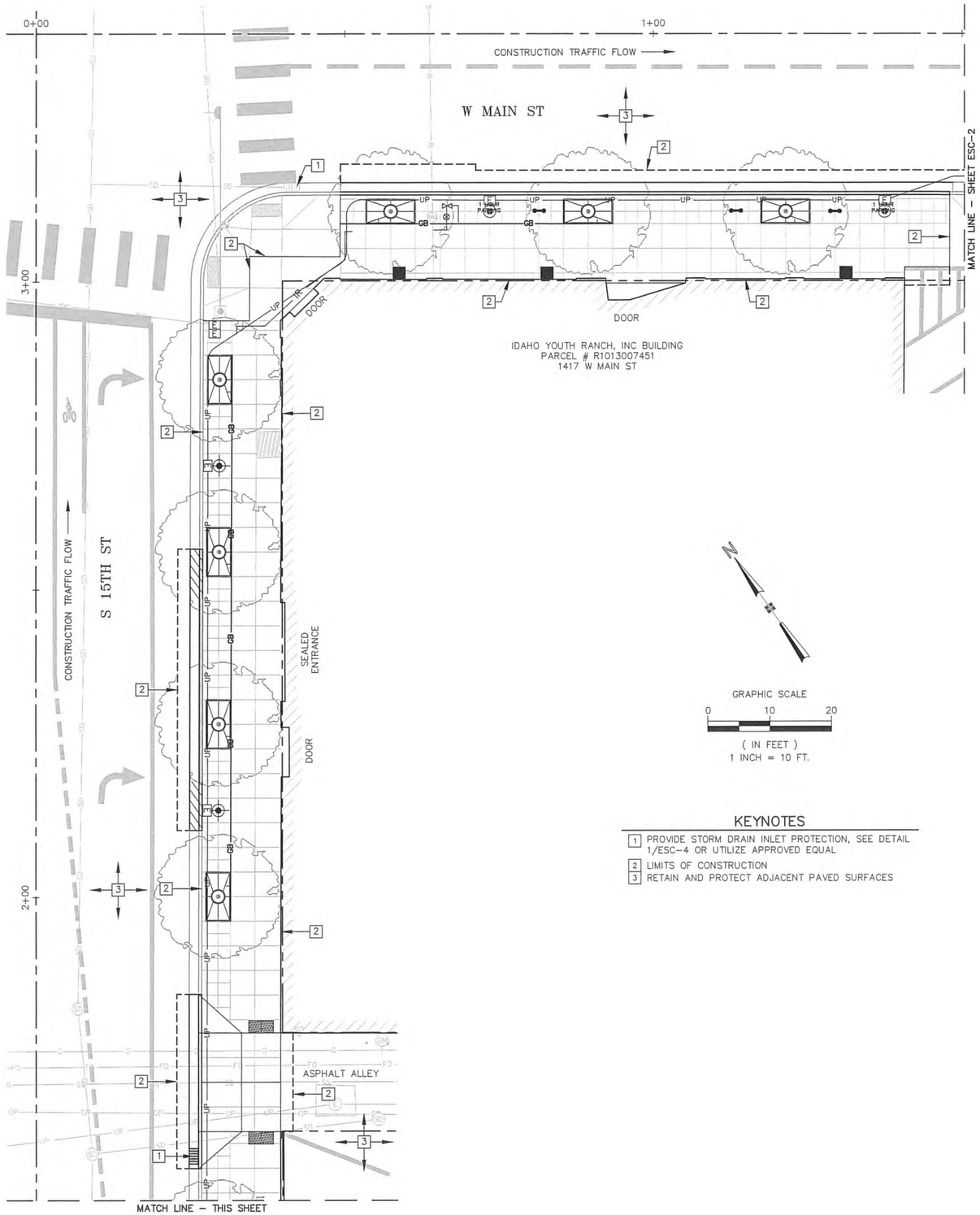
Sheet Title
EROSION AND SEDIMENT CONTROL PLAN

Sheet Number
ESC-2
Of Sheets



KEYNOTES

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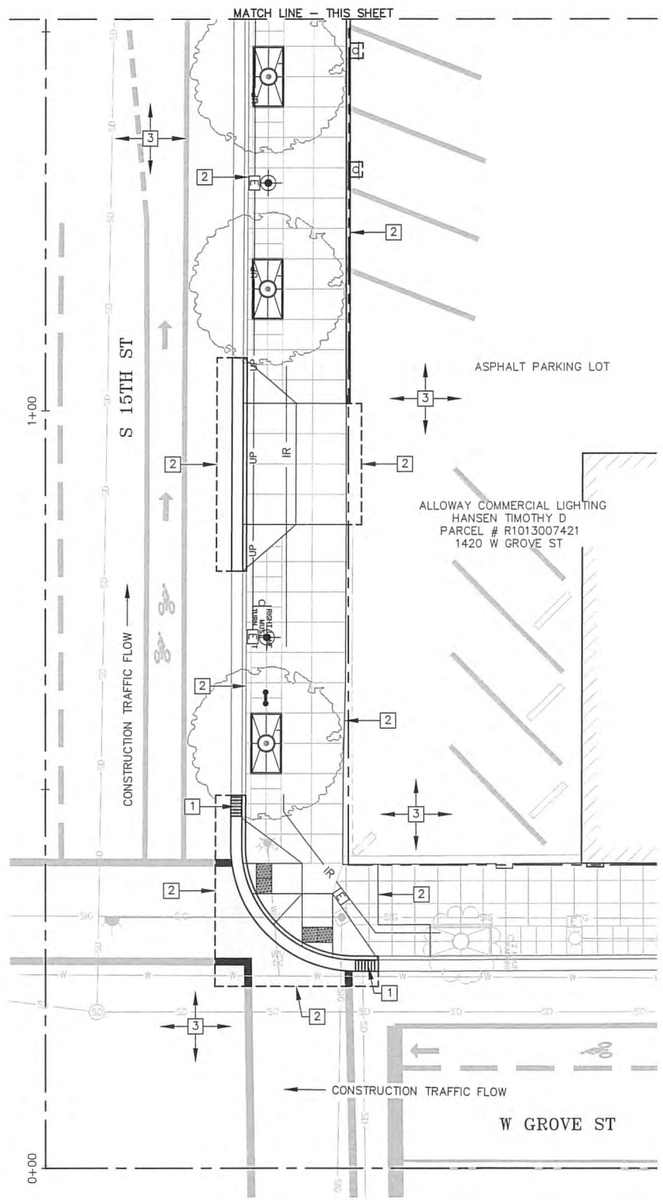
3. RETAIN AND PROTECT ADJACENT PAVED SURFACES



15TH & MAIN STREET
(MAIN ST TO GROVE ST - EAST SIDE)

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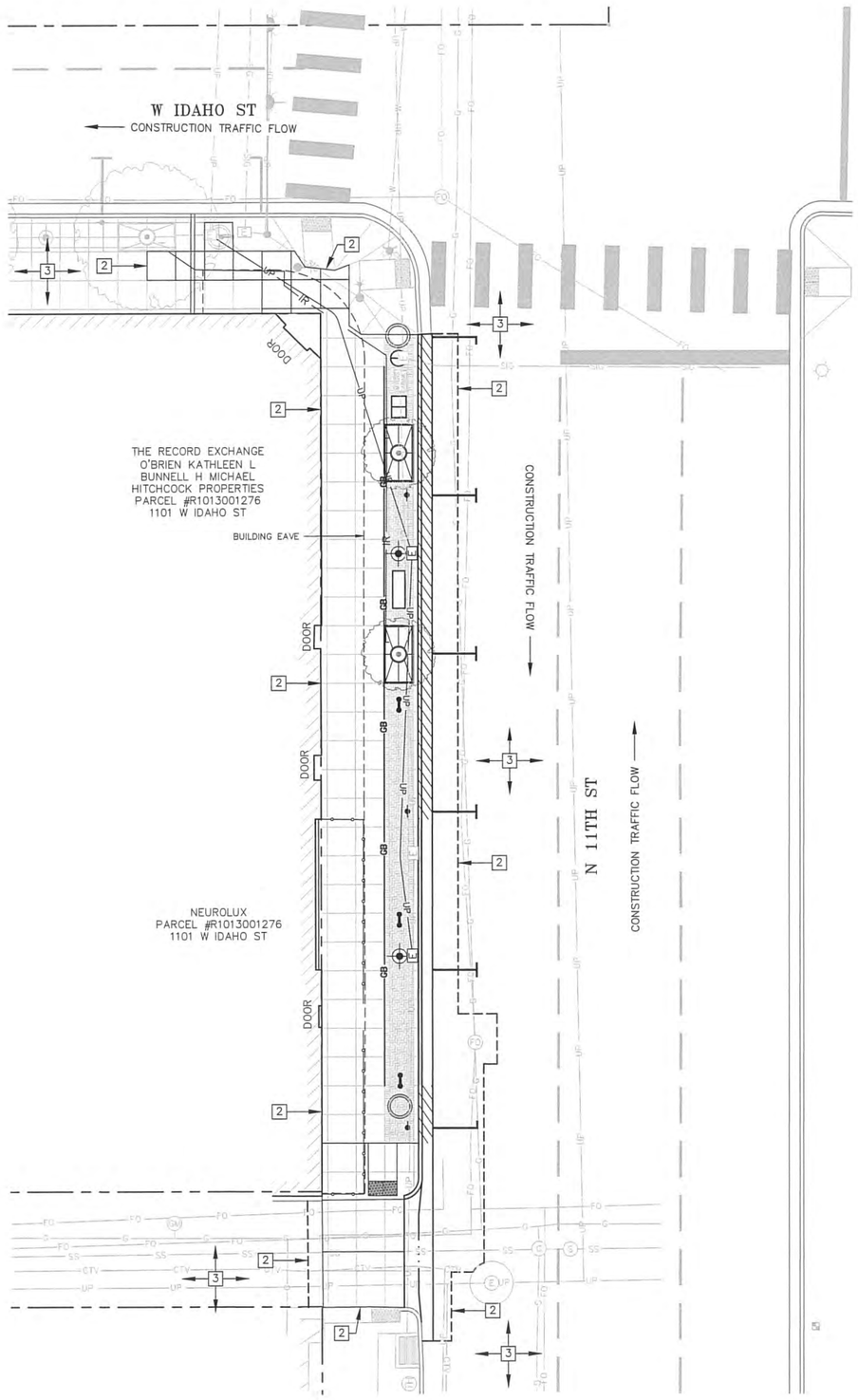
EROSION AND SEDIMENT CONTROL PLAN

Sheet Number
ESC-3
Of Sheets



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KEYNOTES

2 LIMITS OF CONSTRUCTION
3 RETAIN AND PROTECT ADJACENT PAVED SURFACES

THE PATENTED DANDY BAG IS DESIGNED FOR USE WITH FLAT GRATES (INCLUDING ROUND) AND MOUNTABLE CURBS TO DETAIN SEDIMENT-LADEN STORM WATER. THE SUSPENDED SOLIDS ARE ALLOWED TO SETTLE OUT OF THE SLOWED FLOW PRIOR TO ENTERING THE DANDY BAG.

INSTALLATION

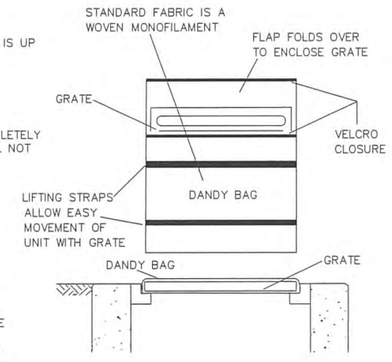
1. STAND THE GRATE ON END
2. PLACE THE DANDY BAG OVER THE GRATE
3. ROLL THE GRATE OVER SO THAT THE OPEN END IS UP
4. PULL UP THE SLACK
5. TUCK THE FLAP IN
6. PRESS THE VELCRO STRIPS TOGETHER
7. BE SURE THAT THE END OF THE GRATE IS COMPLETELY COVERED BY THE FLAP OR THE DANDY BAG WILL NOT WORK PROPERLY
8. HOLDING THE HANDLES, CAREFULLY PLACE THE DANDY BAG WITH THE GRATE INSERTED INTO THE CATCH BASIN FRAME

MAINTENANCE

TO ENSURE PROPER OPERATION REMOVE SILT, SEDIMENT, AND DEBRIS FROM THE SURFACE AND THE VICINITY OF THE UNIT WITH A SQUARE POINT SHOVEL OR STIFF BRISTLE BROOM AWAY FROM ENVIRONMENTALLY SENSITIVE AREAS AND WATERWAYS IN MANNER SATISFACTORY TO THE ENGINEER/INSPECTOR. REMOVE FINE MATERIAL FROM INSIDE DANDY BAG AS NEEDED. DISPOSE OF DANDY BAG NO LONGER IN USE AT AN APPROPRIATE RECYCLING OR SOLID WASTE FACILITY.

INLET INSPECTION

TO INSPECT INLET, REMOVE DANDY BAG WITH GRATE INSIDE, INSPECT CATCH BASIN AND REPLACE DANDY BAG BACK INTO GRATE FRAME.



PONDING IS LIKELY IF SEDIMENT IS NOT REMOVED REGULARLY. THE DANDY BAG MUST NEVER BE USED WHERE OVERFLOW MAY ENDANGER AN EXPOSED SLOPE. THE DANDY BAG IS NOT INTENDED FOR ANY OTHER USE AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

STORM DRAIN INLET SEDIMENT CONTROL DEVICE DETAIL 1 / ESC-4
NTS

11TH STREET
(IDAHO ST SOUTH TO ALLEY - WEST SIDE)

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STREET TREE LIST

REFERENCE NOTE 6 (THIS SHT), DTL 1 (SHT ST-2), DTL 3 (SHT ST-3) & SPECIFICATION SECTION SP-1951 (SHT ST-8)

STREET	SHEET	COMMON NAME	BOTANICAL NAME	SIZE	QUANTITY
15TH STREET (MAIN TO IDAHO)	ST-4	RED OAK	QUERCUS RUBRA	2 1/2" CAL B&B	7 (PARKSTRIP)
MAIN STREET	ST-5 ST-6	SKYLINE HONEYLOCUST	GLEDITSIA TRICANTHOS 'SKYCOLE'	2 1/2" CAL B&B	13 (TREE GRATES)
15TH STREET (MAIN TO GROVE)	ST-6	GREENSPIRE LINDEN	TILIA CORDATA 'GREENSPIRE'	2 1/2" CAL B&B	7 (TREE GRATES)
11TH STREET	ST-7	CAPITAL PEAR	PYRUS CALLERYANA 'CAPITAL'	2 1/2" CAL B&B	2 (TREE GRATES)

* 15TH STREET (MAIN TO IDAHO) TO BE PLANTED IN PARK STRIP. NO TREE GRATES/FRAMES REQUIRED.

TOTAL TREES: 29
(7 PARKSTRIP, 22 TREE GRATES)

PLANT QUANTITY NOTE:
QUANTITIES FOR INFORMATION ONLY. CONTRACTOR TO VERIFY AND ASSUME RESPONSIBILITY FOR ALL PLANT MATERIAL QUANTITIES.

FURNISHING SCHEDULE

REFER TO NOTE 7, THIS SHT. USE CCDC SUPPLIED STREETSCAPE FURNISHING QUANTITY AND COST FOR USE TAX CALCULATION.

ITEM	ORDER & PURCHASE	TAKE DELIVERY & STORE	TRANSPORT TO/INSTALL AT PROJECT SITE
BRICK PAVERS (ENDICOTT)	CONTRACTOR	CONTRACTOR	CONTRACTOR
HISTORIC STREET LIGHTS. INCLUDING POLES, GLASS GLOBES, LED FIXTURES BANNER ARMS & ANCHOR BOLTS. ETC PER DWGS.	CONTRACTOR	CONTRACTOR	CONTRACTOR
STREET TREES	CONTRACTOR	CONTRACTOR	CONTRACTOR
LITTER RECEPTACLES	CONTRACTOR	CONTRACTOR	CONTRACTOR
BIKE RACKS	CONTRACTOR	CONTRACTOR	CONTRACTOR
CONTRACTOR PROVIDED SILVA CELLS & DECKS	CONTRACTOR	CONTRACTOR	CONTRACTOR

ITEM		QUANTITY	UNIT COST	TOTAL COST	STORAGE LOCATION	
CCDC PROVIDED SILVA CELLS & DECKS * SEE BELOW FOR PROVIDED ITEMS & QUANTITIES	CCDC	SEE BELOW	SEE BELOW	SEE BELOW	CCDC WAREHOUSE 620 S. 9TH STREET BOISE, IDAHO 83702	CONTRACTOR
4' BENCH	CCDC	1	$ 998.00	$ 998.00	CCDC WAREHOUSE 620 S. 9TH STREET BOISE, IDAHO 83702	CONTRACTOR
4' X 8' TREE GRATES & FRAMES (SET)	CCDC	22	$1,555.00	$34,100.00	CCDC WAREHOUSE 620 S. 9TH STREET BOISE, IDAHO 83702	CONTRACTOR
VENT GRATES & FRAMES (SET)	CCDC	3	$ 490.00	$ 1,470.00	CCDC WAREHOUSE 620 S. 9TH STREET BOISE, IDAHO 83702	CONTRACTOR
HISTORIC STREET LIGHT	CCDC	8	$1,870.00	$14,960.00	CCDC WAREHOUSE 620 S. 9TH STREET BOISE, IDAHO 83702	CONTRACTOR

* CCDC PROVIDED SILVA CELLS ITEMS:

ITEM	QUANTITY	UNIT COST	TOTAL COST
GEOGRID	1 ROLL (12' x 150')	$ 534.55	$ 534.55
NEEDLE PUNCHED NON-WOVEN PP GEOTEXTILE FABRIC	1 ROLL (15' x 300')	$ 787.75	$ 788.00
SILVA CELLS CABLE/ZIP TIES	2	$ 9.45	$ 19.90
SILVA CELL DECKS	100	$ 73.20	$ 7,320.00
SILVA CELL FRAMES	200	$ 61.40	$ 12,280.00
SILVA CELL SPIKES	2 CARTONS (225 PER CARTON)	$ 150.00	$ 300.00
		SUBTOTAL	$ 21,242.20
		FREIGHT	$ 2,772.00
		TOTAL	$ 24,014.20

GENERAL NOTES

1. LOCATE AND PROTECT ALL UTILITIES DURING CONSTRUCTION UNLESS OTHERWISE NOTED PER CIVIL DWGS. ADJUST TO FINISH ELEVATION.
2. RETAIN AND PROTECT ALL TRAFFIC SIGNAL WIRING AND CONDUIT, OR REPLACE AS NECESSARY IN ACCORDANCE TO ACHD REQUIREMENTS. REFER TO CIVIL DWGS.
3. ALL WORK SHALL BE IN COMPLIANCE WITH LATEST EDITION ISPWC SPECIFICATIONS & DETAILS AND SPECIAL PROVISIONS. REFER TO SP-1450, SP-1950, AND SP-1951, SHT ST-8 FOR LANDSCAPE REQUIREMENTS.
4. REFER TO ELECTRICAL DRAWINGS FOR ALL LIGHTING REQUIREMENTS.
5. IRRIGATION: PROVIDE THE FOLLOWING AT TWO (2) NEW POINT OF CONNECTION LOCATIONS PER PLANS - CONNECT TO EXIST SUPPLY. CONSTRUCT IRRIGATION SERVICE INCLUDING TRAFFIC RATED VALVE BOXES IN APPROVED LOCATIONS, 3/4" MANUAL CONTROL VALVE, 3/4" MANUAL DRAIN VALVE, 3/4" DOUBLE CHECK VALVE, PROVISION FOR WINTERIZATION, DRIP CONTROL ZONE AND/OR REMOTE CONTROL VALVE WITH BATTERY OPERATED NODE CONTROLLER. ONE STATION PER CONTROLLER UNLESS OTHERWISE AS NOTED.

   PROVIDE 20' DOUBLE LOOP OF DRIPPERLINE TO EACH TREE. IN SILVA CELL LOCATIONS, INSTALL DRIP LINE BETWEEN SILVA CELL ROWS, 2' O.C. PLACE ON PLANTING SOIL SURFACE TUCKED BETWEEN SILVA CELL TOP DECKS. REFER TO CIVIL SILVA CELL DWGS AND DETAILS, SHTS C-12 & C-13.

   IRRIGATION SUPPLY TO BE 1" SUPPLY IN 2" SLEEVE (UNLESS OTHERWISE NOTED), REPRESENTED AS IR ON PLANS. REFER TO SP-1450, SHT ST-8 FOR IRRIGATION REQUIREMENTS.

   ADDITIONAL IRRIGATION NOTES AS FOLLOWS:

   BIG-O TIRE BUILDING (1422 W. MAIN): 15TH (EAST SIDE) AND MAIN ST (NORTH SIDE) - SHT ST-4:
   CONNECT NEW IRRIGATION TO EXISTING WATER METER ON MAIN ST, (MAIN ST SIDE OF BIG-O TIRE BUILDING) AND PROVIDE ONE POINT OF CONNECTION & VALVES FOR TREE DRIPPERLINE AND LAWN SPRAY ZONES AS SHOWN ON PLAN & DIRECTED ABOVE. NEW IRRIGATION SYSTEM TO HAVE ONE VALVE TO IRRIGATE SILVA CELLS AND TWO (2) TREE WELLS ON MAIN ST. AND TWO VALVES TO FEED LAWN SPRAY ZONES ON 15TH ST. THREE STATIONS REQUIRED. BORE UNDER EXISTING CONCRETE PAVING TO REMAIN ON CORNER. CONTACT BUILDING OWNER TO COORDINATE ANY EXISTING IRRIGATION SYSTEM CONNECTED WITH STREETSCAPE/BUILDING LANDSCAPE.

   ECHELON BUILDING (1404 W. MAIN): MAIN ST (NORTH SIDE) - SHT ST-5:
   CONNECT IRRIGATION TO EXISTING WATER METER AND EXISTING IRRIGATION SYSTEM AS SHOWN ON PLAN AND DIRECTED ABOVE. PROVIDE NEW DRIP VALVE TO IRRIGATE SILVA CELLS, AND FOUR (4) TREE WELLS ON MAIN ST (NORTH SIDE). CONTACT BUILDING OWNER TO COORDINATE ANY EXISTING IRRIGATION SYSTEM CONNECTED WITH STREETSCAPE/BUILDING LANDSCAPE.

   PETSO BUILDING (1409 W. MAIN): MAIN ST (SOUTH SIDE) - SHT ST-5:
   CONNECT IRRIGATION TO EXISTING WATER METER AND EXISTING IRRIGATION SYSTEM AT ADJACENT PARKING LOT (1401 MAIN ST) AS SHOWN ON PLAN AND DIRECTED ABOVE. CONNECT TO EXISTING DRIP VALVE TO IRRIGATE SILVA CELLS, AND FOUR (4) TREE WELLS ON MAIN ST (SOUTH SIDE).

   IDAHO YOUTH RANCH BUILDING (1417 W. MAIN): MAIN ST (SOUTH SIDE)/15TH ST (SOUTH SIDE) - SHT ST-6:
   CONNECT NEW IRRIGATION TO EXISTING WATER METER ON MAIN STREET (IN FRONT OF IDAHO YOUTH RANCH) AND PROVIDE NEW POINT OF CONNECTION & DRIPPERLINE AS SHOWN ON PLAN & DIRECTED ABOVE. NEW IRRIGATION SYSTEM TO IRRIGATE SILVA CELLS AND SEVEN (7) TREE WELLS ON MAIN AND 15TH ST. BORE UNDER EXISTING CONCRETE PAVING TO REMAIN ON CORNER.

   ALLOWAY LIGHTING BUILDING (1420 GROVE ST): 15TH ST (EAST SIDE) - SHT ST-6:
   CONNECT IRRIGATION TO EXISTING WATER METER AND EXISTING IRRIGATION SYSTEM ON GROVE ST (ADJACENT TO SOUTH SIDE OF ALLOWAY BUILDING) AS SHOWN ON PLAN AND DIRECTED ABOVE. CONNECT TO EXISTING DRIP VALVE TO IRRIGATE SILVA CELLS, AND THREE (3) TREE WELLS ON 15TH ST. BORE UNDER EXISTING CONCRETE PAVING TO NEAREST TREE WELL ON GROVE ST FOR CONNECTION. CONTACT BUILDING OWNER TO COORDINATE ANY EXISTING IRRIGATION SYSTEM CONNECTED WITH STREETSCAPE/BUILDING LANDSCAPE.

   RECORD EXCHANGE BUILDING (1101 W. IDAHO): 11TH ST (WEST SIDE) - SHT ST-7:
   CONNECT IRRIGATION TO EXISTING WATER METER AND EXISTING IRRIGATION SYSTEM ON IDAHO ST (ADJACENT TO NORTH SIDE OF RECORD EXCHANGE BUILDING) AS SHOWN ON PLAN AND DIRECTED ABOVE. CONNECT TO EXISTING DRIP VALVE TO IRRIGATE TWO (2) TREE WELLS ON 11TH ST. BORE UNDER EXISTING CONCRETE PAVING TO IRRIGATION VALVE ON IDAHO ST FOR CONNECTION. CONTACT BUILDING OWNER TO COORDINATE ANY EXISTING IRRIGATION SYSTEM CONNECTED WITH STREETSCAPE/BUILDING LANDSCAPE.
6. BOISE CITY FORESTRY REQUIRES WITNESSING TREE PLANTING DEMONSTRATION AT FIRST TREE INSTALLATION. REFER TO SP-1951, SHT ST-8.
7. THE CONTRACTOR IS TO PROVIDE AND INSTALL THE FOLLOWING STREETSCAPE FURNISHINGS PER CCDC DOWNTOWN BOISE STREETSCAPE STANDARDS AT LOCATIONS AS INDICATED ON THE DWGS. QUANTITIES FOR INFORMATION ONLY. CONTRACTOR TO VERIFY AND ASSUME RESPONSIBILITY FOR QUANTITIES:
   - ENDICOTT PAVERS
   - TEN (10) HISTORIC LIGHTS (SEE ELECTRICAL),
   - STREET TREES
   - ONE (1) LITTER RECEPTACLE. CHASE PARK MODEL BY LANDSCAPE FORMS 1-800-521-2546. SIDE OPENING WITH 36 GALLON BLACK POLYETHYLENE LINER, POWDERCOAT COLOR IVY AS WITH GRAFFITI RESISTANT CLEARCOAT. SURFACE MOUNT WITH 3/8" ANCHOR BOLTS (PROVIDED).
   - SIX (6) SURFACE MOUNT STANDARD LOOP BIKE RACKS. "SINGLE BEND" BIKE RACK. KB FABRICATION AND WELDING INC., (208) 898-9353. REFER TO DTL 3, SHT ST-2.
   - THREE (3) DIRECT BURY STANDARD LOOP BIKE RACKS. "SINGLE BEND" BIKE RACK. KB FABRICATION AND WELDING INC., (208) 898-9353. REFER TO DTL 3, SHT ST-2.
   - SILVA CELLS & DECKS (MINUS AMOUNT PROVIDED BY CCDC).

   THE FOLLOWING STREETSCAPE FURNISHINGS WILL BE PROVIDED BY CCDC AND STORED FOR CONTRACTOR PICKUP AT THE CCDC STORAGE FACILITY, 620 S. 9TH ST IN DOWNTOWN BOISE. CONTACT BEN HOUPT AT CCDC, 384-4264, TO ARRANGE FOR STORAGE ACCESS. THE CONTRACTOR WILL BE RESPONSIBLE FOR ASSEMBLY; TRANSPORT TO THE SITE; INSTALLATION AS PER THE DRAWINGS AND CCDC STANDARD DETAILS; TOUCHUP PAINT AS NECESSARY; & FOR DISPOSAL & CLEANUP OF ALL PACKAGING/DELIEVERY MATERIALS. QUANTITIES FOR INFORMATION ONLY. CONTRACTOR TO VERIFY AND ASSUME RESPONSIBILITY FOR QUANTITIES:
   - PARTIAL SILVA CELLS & DECKS.
   - ONE (1) 4' BENCH
   - TWENTY-TWO (22) 4'x8' TREE GRATES & FRAMES, REFER TO DTL 1, SHT ST-2,
   - THREE (3) 2'X2' VENT GRATES & FRAMES, REFER TO DTL 1, SHT ST-2,
   - EIGHT (8) HISTORIC LIGHTS (SEE ELECTRICAL),

   REFER TO FURNISHING SCHEDULE, THIS SHEET FOR RESPONSIBLE PARTY OF ORDER, DELIVERY, STORAGE, TRANSPORTATION, AND INSTALLATION.

LEGEND OF CALLOUTS

SYMBOL	CALLOUT	DESCRIPTION
	AP	CONSTRUCT BRICK APPROACH WITH CONC APRON. & CONC BAND ADJACENT TO ASPHALT. REFER TO DTLS 1 & 2, SHT ST-3.
	BB	BRICK/CONCRETE STREETSCAPE STANDARD. REFER TO DTL 5, SHT ST-2 & DTL 1, SHT ST-3. FURNISHING ZONE: INSTALL RED BRICK DRY LAID PAVERS, SINGLE SOLDIER COURSE EACH SIDE WITH HERRINGBONE FIELD. REFER TO DTL 1, SHT ST-3 FOR BRICK PATTERN.
	BI	INSTALL OWNER PROVIDED BENCH. 4' LENGTH, CAST IRON W/ RESIN/WOOD SLATS, COLOR RAL 6009. SURFACE MOUNT W/ (4) 3/8" x 4" EXPANSION BOLDS. SEE NOTE 7.
	CG	CONSTRUCT CURB & GUTTER. SEE CIVIL DWGS.
	CS	CONSTRUCT CONCRETE SIDEWALK. PER DTL 4, SHT ST-2 & ISPWC SEC 700. LT BRM FIN. 3/8"W X 3/4"D TOOLED JOINTS AS SHOWN & DTL 2, ST-3.
	HL	PROVIDE AND INSTALL HISTORIC LIGHT. SEE ELECTRICAL DWGS.
	LR	PROVIDE & INSTALL LITTER RECEPTACLE SIDE OPENING W/ 36 GAL BLACK POLYETHYLENE LINER, POWDERCOAT COLOR "IVY AS" W/ GRAFFITI RESISTANT CLEARCOAT BY MFG. SURFACE MOUNT W/ 3/8" ANCHOR BOLTS (PROVIDED). SEE NOTE 7.
	PM	PARKING METER. COORDINATE WITH BOISE CITY FOR REMOVAL AND INSTALLATION, LOCATE AS SHOWN ON DWGS.
	PP	PRE-CAST PLANTERS PROVIDED & INSTALLED BY OTHERS. LOCATIONS AS SHOWN ON PLAN. SEE NOTE 7.
	PR	PEDESTRIAN RAMP. SEE CIVIL DWGS.
	RI	PROVIDE & INSTALL STANDARD BIKE RACK LOOP. SURFACE MOUNT. POWDERCOAT RAL-6009. SEE NOTE 7 & DTL 3, SHT ST-2.
	R2	PROVIDE & INSTALL STANDARD BIKE RACK LOOP. DIRECT BURY. POWDERCOAT RAL-6009. SEE NOTE 7 & DTL 3, SHT ST-2.
	RC	RETAIN/PROTECT EXIST CURB & GUTTER. SEE CIVIL DWGS.
	RS	RETAIN/PROTECT EXIST PAVING. REPAIR/REPLACE ALL CONSTRUCTION DAMAGES.
	TW*	4'x8' TREE WELL. INSTALL OWNER PROVIDED GRATE & FRAME, SEE NOTE 6 & 7, AND DTL 1, SHT ST-2 FOR GRATE & FRAME INFORMATION. SEE TREE LIST FOR STREET TREE SPECIES, THIS SHT.
	T	INSTALL TREE PER DTL 3, SHT ST-3 AND SPEC SECTION SP 1951. SEE TREE LIST FOR STREET TREE SPECIES, THIS SHT.
	TR	PRE-CAST CONC TRUNCATED DOMES. REFER TO CIVIL DWGS.
	VG	2'x2' VENT GRATE (TYP OF THREE). INSTALL OWNER PROVIDED GRATE & FRAME, SEE NOTE 7, AND DTL 1, SHT ST-2 FOR GRATE & FRAME INFORMATION.
—IR—		IRRIGATION SUPPLY. 2" SLEEVE WITH 1" SUPPLY UNLESS OTHERWISE NOTED. SEE NOTE 5.

* INSTALL DEEPROOT ROOT BARRIER (OR APPROVED EQUAL) THAT EXTENDS 18" BELOW THE SUB GRADE ON ALL SIDEWALK SIDE AND 24" BELOW THE SUB GRADE ON THE CURB SIDE. SEE DTL 1, SHT ST-2, WHERE OCCURS.

Issue Description	Date
PERMIT	4/8/15
IYR VENTS	4/21/15
BID SET	5/27/15

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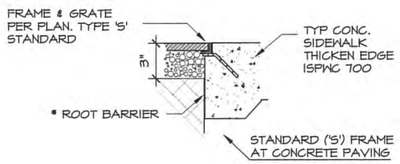
2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

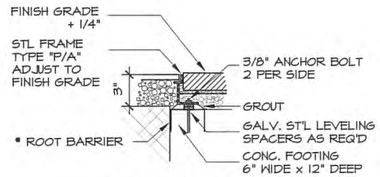
Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

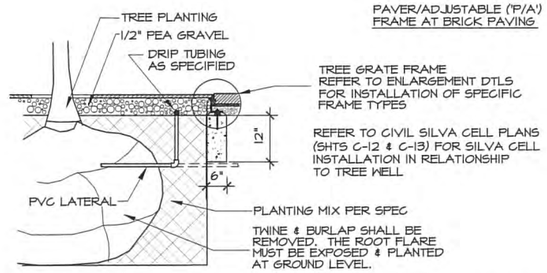
Sheet Title: Streetscape Notes

Sheet Number: ST-1
Of Sheets





PAVER/ADJUSTABLE ('P/A')
FRAME AT BRICK PAVING



* INSTALL DEEPROOT ROOT BARRIER (OR APPROVED EQUAL) THAT EXTENDS 18" BELOW THE SUB GRADE ON ALL SIDEWALK SIDE AND 24" BELOW THE SUB GRADE ON THE CURB SIDE.

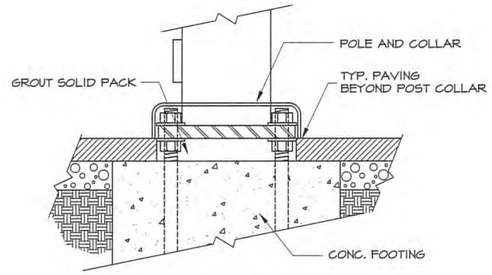
- INSTALL OWNER PROVIDED TWENTY-TWO (22) CIP 4'x8' TREE GRATES AND FRAMES. TO BE "KIVA" BY URBAN ACCESSORIES (425) 487-0488.

MAIN STREET (NORTHSIDE)-	6 (4'x8') - TYPE "S" (4 SIDES)
MAIN STREET (SOUTHSIDE)-	7 (4'x8') - TYPE "S" (4 SIDES)
15TH STREET (MAIN TO GROVE)-	7 (4'x8') - TYPE "S" (4 SIDES)
11TH STREET-	2 (4'x8') - TYPE "P/A" (2 SHORT SIDES) TYPE "S" (2 LONG SIDES)
	22 TOTAL

- INSTALL OWNER PROVIDED THREE (3) CIP 2'x2' VENT GRATES AND FRAMES. TO BE "JAMISON' BY URBAN ACCESSORIES (425) 487-0488. SIM TO TYPE "S" STANDARD FRAME DTL AS SHOWN ABOVE. REFER TO S-1.1 FOR STRUCTURAL DETAIL FOR FRAME INSTALLATION.

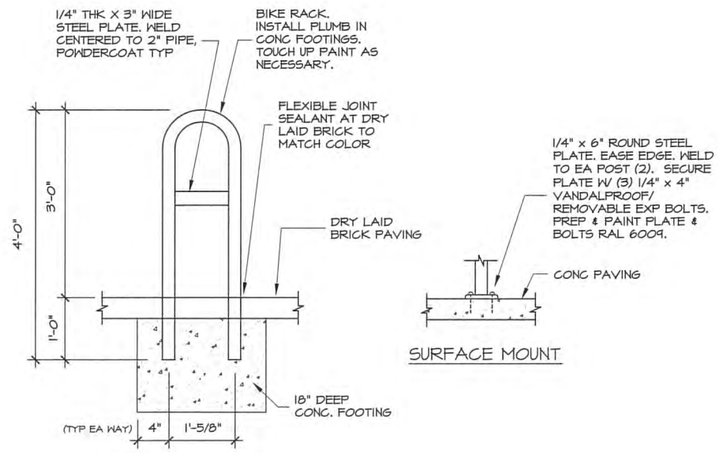
MAIN STREET (SOUTHSIDE)- ADJACENT TO IDAHO YOUTH RANCH — 3 (2'x2') - TYPE "S" (4 SIDES)

1 TREE WELL SECTION
NOT TO SCALE



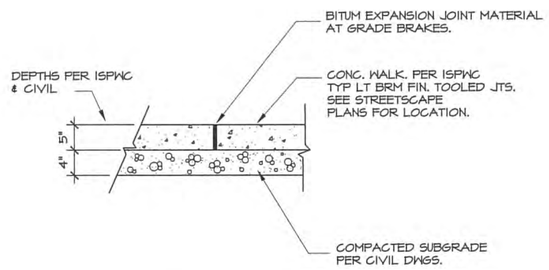
NOTE: GROUT AT POLE BASE WITH WEEP HOLE AT LOW POINT. APPLIES TO ALL UTILITY/LIGHT POLES. REFER TO ELECTRICAL PLANS.

2 POLE BASE
NOT TO SCALE



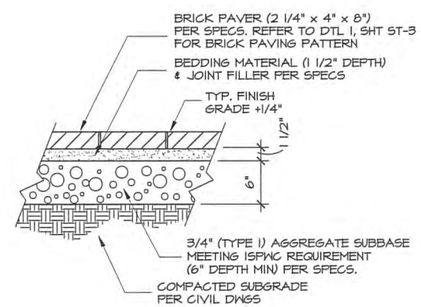
NOTE:
PROVIDE AND INSTALL BIKE RACK: 'SINGLE BEND' BIKE RACK BY KB FABRICATION AND WELDING, INC. (208) 848-4353. BIKE RACK TO BE 2" ROUND SCH 40 STEEL PIPE; BEND TO FORM & DIMENSIONS AS SHOWN. POWDERCOAT RAL-6009.

3 BIKE RACK
NOT TO SCALE



NOTE: REFER TO CIVIL DWGS FOR DEPTHS OF TRAFFIC RATED SIDEWALK SECTIONS. REFER TO DTL 2, SHT ST-3 FOR STANDARD CONCRETE STREETSCAPE SCORING PATTERN.

4 SIDEWALK CONCRETE PAVING SECTION
NOT TO SCALE



5 SIDEWALK BRICK PAVING SECTION
NOT TO SCALE

Issue Description	Date
PERMIT	4/8/15
1YR VENTS	4/21/15
BID SET	5/27/15

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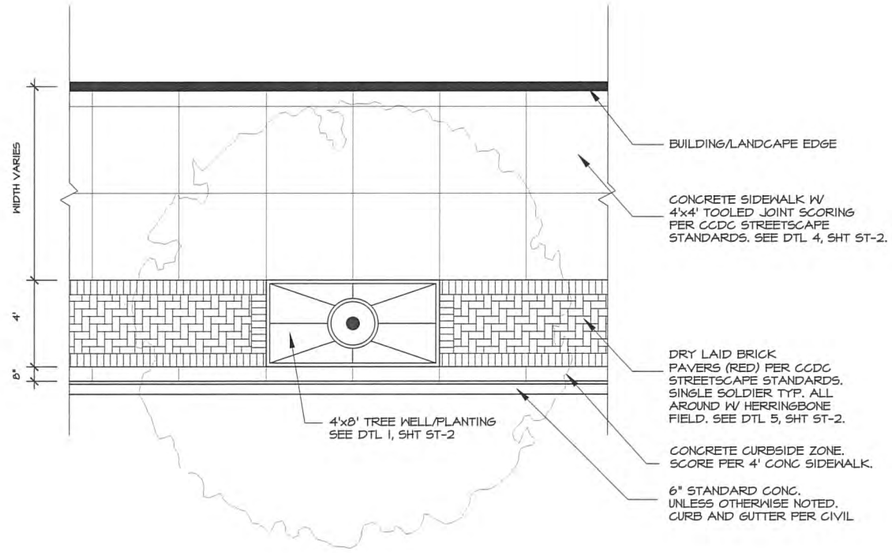
2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

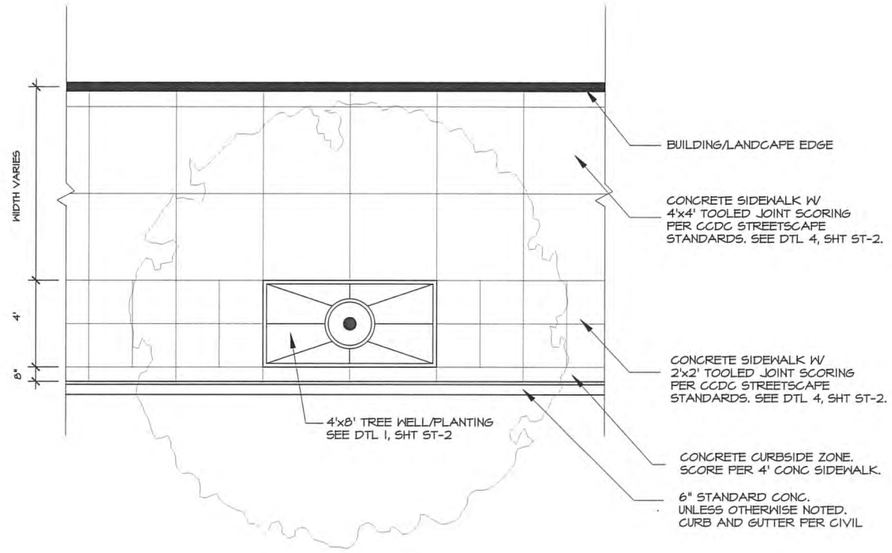
Sheet Title
Streetscape Details

Sheet Number
ST-2
Of Sheets



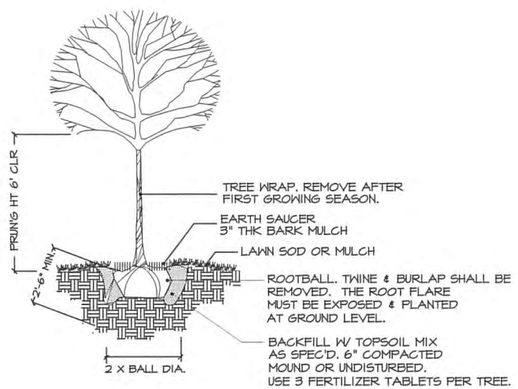
1 BRICK & CONCRETE PAVING PATTERN

NOT TO SCALE



2 CONCRETE PAVING PATTERN

NOT TO SCALE



REFER TO TREE LIST SHT ST-1 FOR STREET TREE SPECIES AND SIZE.

3 TREE PLANTING

NOT TO SCALE

Issue Description	Date
PERMIT	4/8/15
BID SET	5/27/15

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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO

CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

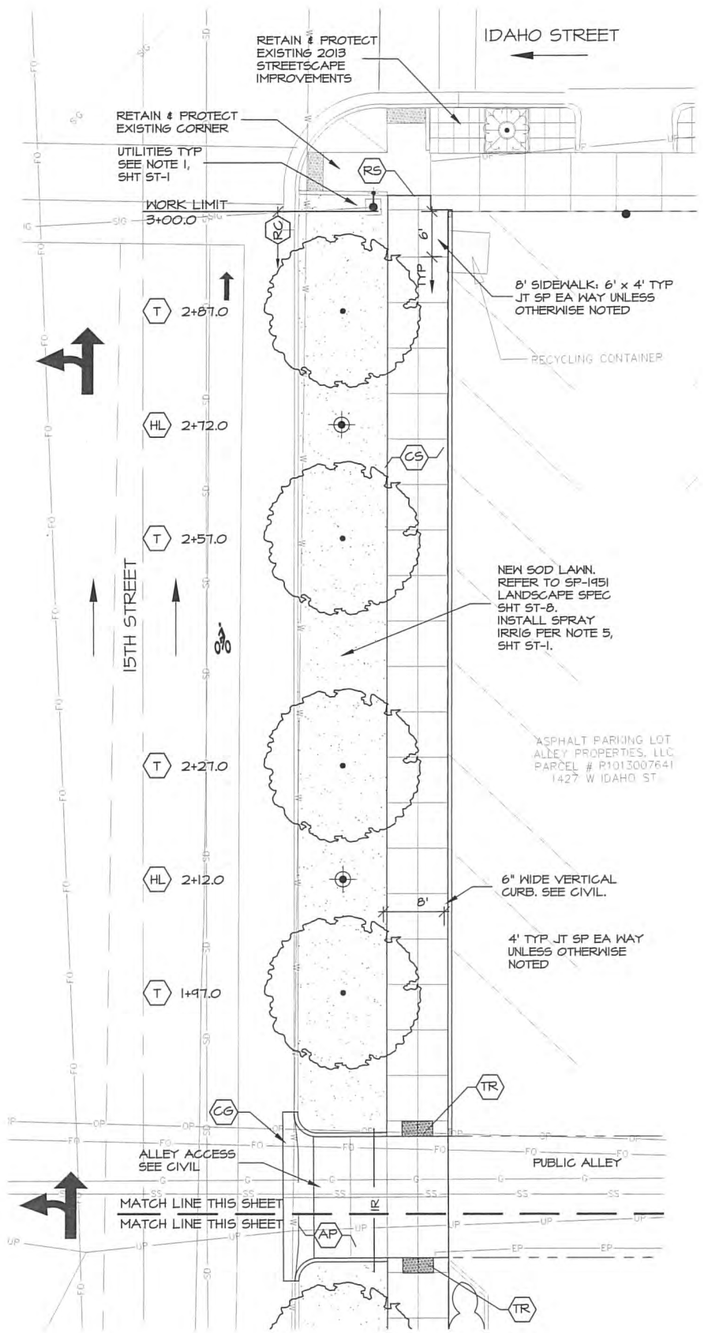
Sheet Title

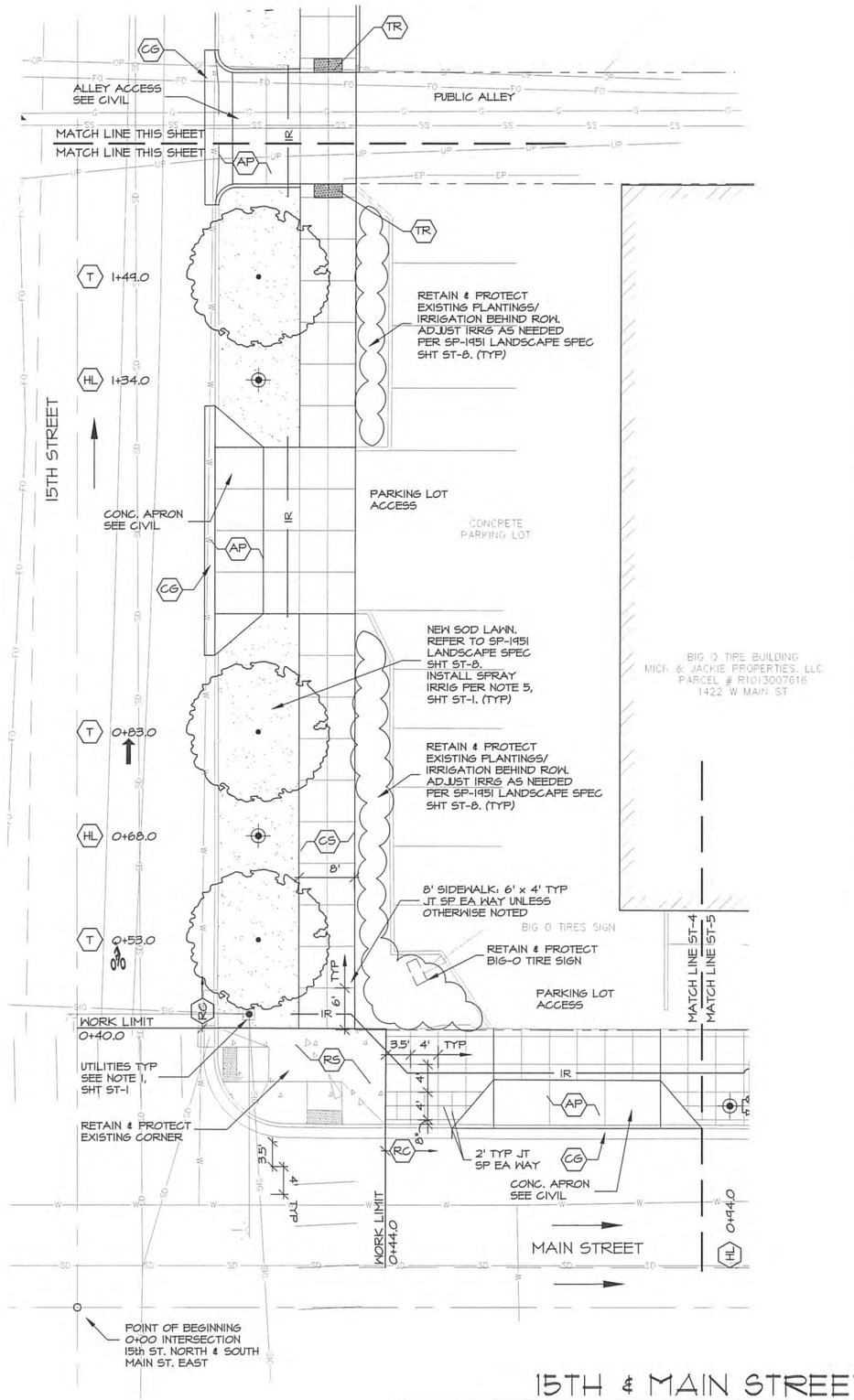
Streetscape Details

Sheet Number

ST-3

Of Sheets





15TH & MAIN STREET
(Main St. to Idaho St. - east side)

LEGEND OF CALLOUTS

(REFER TO SHT ST-1)

SYMBOL	CALLOUT	DESCRIPTION
	AP	CONSTRUCT BRICK APPROACH WITH CONCRETE APRON
	BB	BRICK/CONCRETE STREETSCAPE STANDARD
	BI	4 FOOT BENCH.
	CG	CONSTRUCT CURB & GUTTER.
	CS	CONSTRUCT CONCRETE SIDEWALK.
	HL	HISTORIC LIGHT.
	LR	LITTER RECEPTACLE.
	PM	PARKING METER.
	PP	PRE-CAST PLANTERS.
	PR	PEDESTRIAN RAMP.
	R1	BIKE RACK STANDARD. SURFACE MOUNT.
	R2	BIKE RACK STANDARD. DIRECT BURY.
	RC	RETAIN & PROTECT EXIST CURB & GUTTER.
	RS	RETAIN & PROTECT EXIST PAVING.
	TW	4'x8' TREE WELL.
	T	TREE PLANTING
	TR	TRUNCATED DOMES.
	VG	2'x2' VENT GRATE & FRAME.
—IR—		IRRIGATION SUPPLY.

NOTES

1. REFER TO SHT ST-1, ST-2, & ST-3 FOR STREETSCAPE NOTES AND DETAILS.

NORTH

SCALE 1" = 10'

Issue Description	Date
PERMIT	4/6/15
BID SET	5/27/15

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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO

CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

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Scale	As Shown

Sheet Title: **Streetscape Plan**

Sheet Number: **ST-4**

Of Sheets

LEGEND OF CALLOUTS

(REFER TO SHT ST-1)

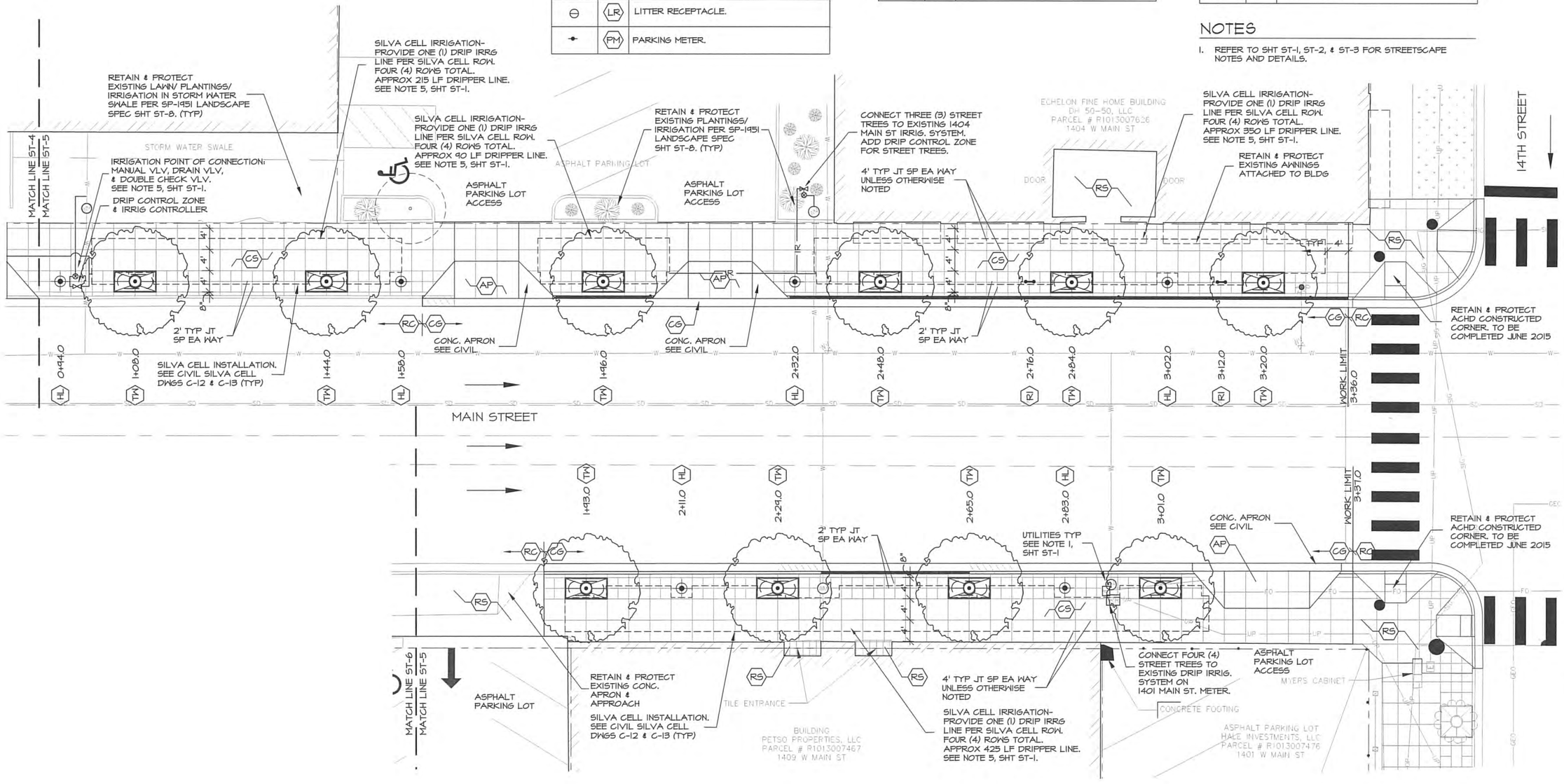
SYMBOL	CALLOUT	DESCRIPTION
	AP	CONSTRUCT BRICK APPROACH WITH CONCRETE APRON
	BB	BRICK/CONCRETE STREETSCAPE STANDARD
	BI	4 FOOT BENCH.
	CG	CONSTRUCT CURB & GUTTER.
	CS	CONSTRUCT CONCRETE SIDEWALK.
	HL	HISTORIC LIGHT.
	LR	LITTER RECEPTACLE.
	PM	PARKING METER.

SYMBOL	CALLOUT	DESCRIPTION
	PP	PRE-CAST PLANTERS.
	PR	PEDESTRIAN RAMP.
	RI	BIKE RACK STANDARD. SURFACE MOUNT.
	R2	BIKE RACK STANDARD. DIRECT BURY.
	RC	RETAIN & PROTECT EXIST CURB & GUTTER.
	RS	RETAIN & PROTECT EXIST PAVING.

SYMBOL	CALLOUT	DESCRIPTION
	TW	4'x8' TREE WELL.
	T	TREE PLANTING
	TR	TRUNCATED DOMES.
	VG	2'x2' VENT GRATE & FRAME.
—IR—		IRRIGATION SUPPLY.

NOTES

1. REFER TO SHT ST-1, ST-2, & ST-3 FOR STREETSCAPE NOTES AND DETAILS.



NORTH SCALE 1" = 10'

MAIN STREET - east end
(15th St. to 14th St.)

Issue Description	Date
PERMIT	4/6/15
BID SET	5/27/15

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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

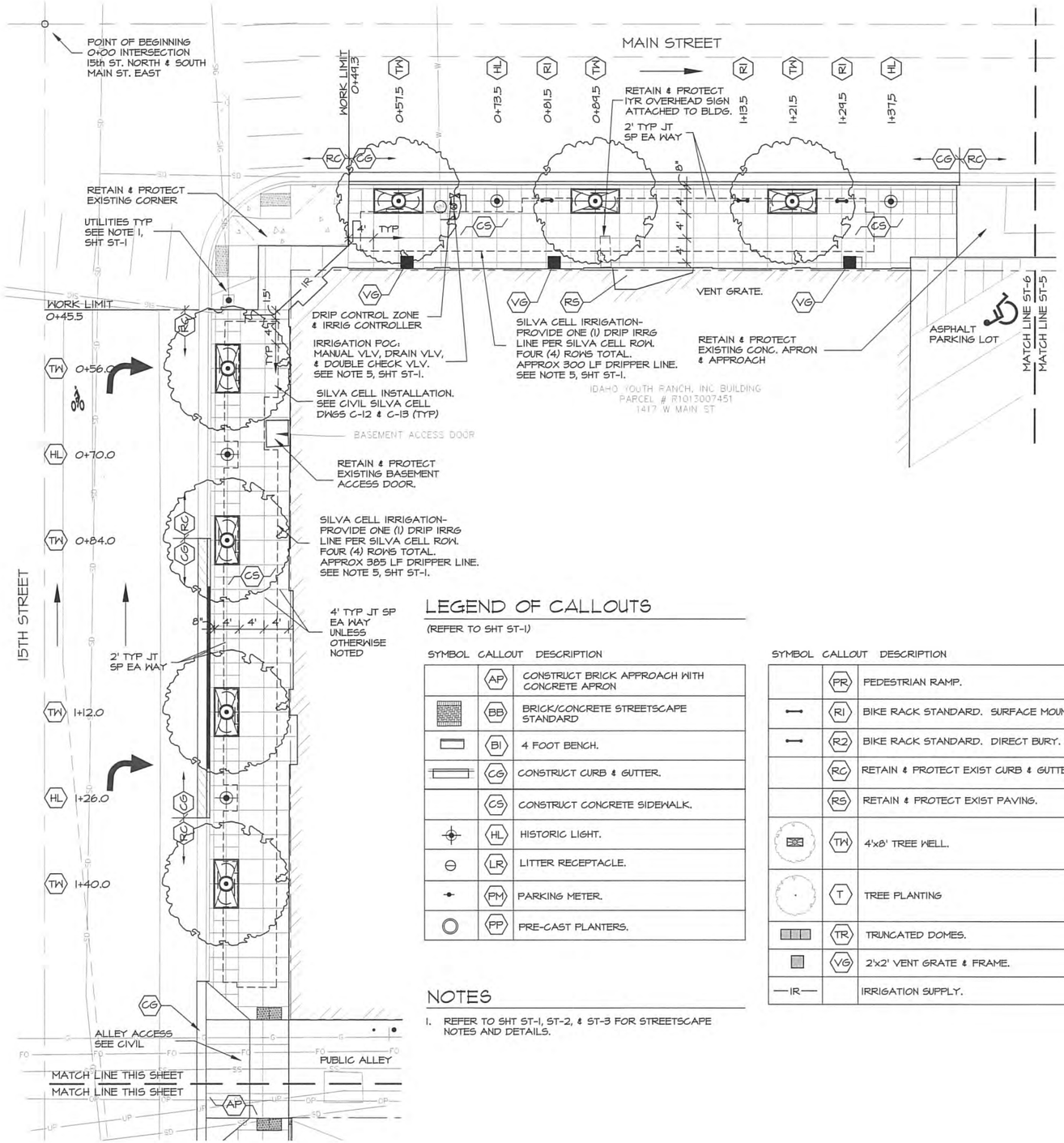
Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

Sheet Title: Streetscape Plan

Sheet Number: ST-5

Of Sheets



LEGEND OF CALLOUTS

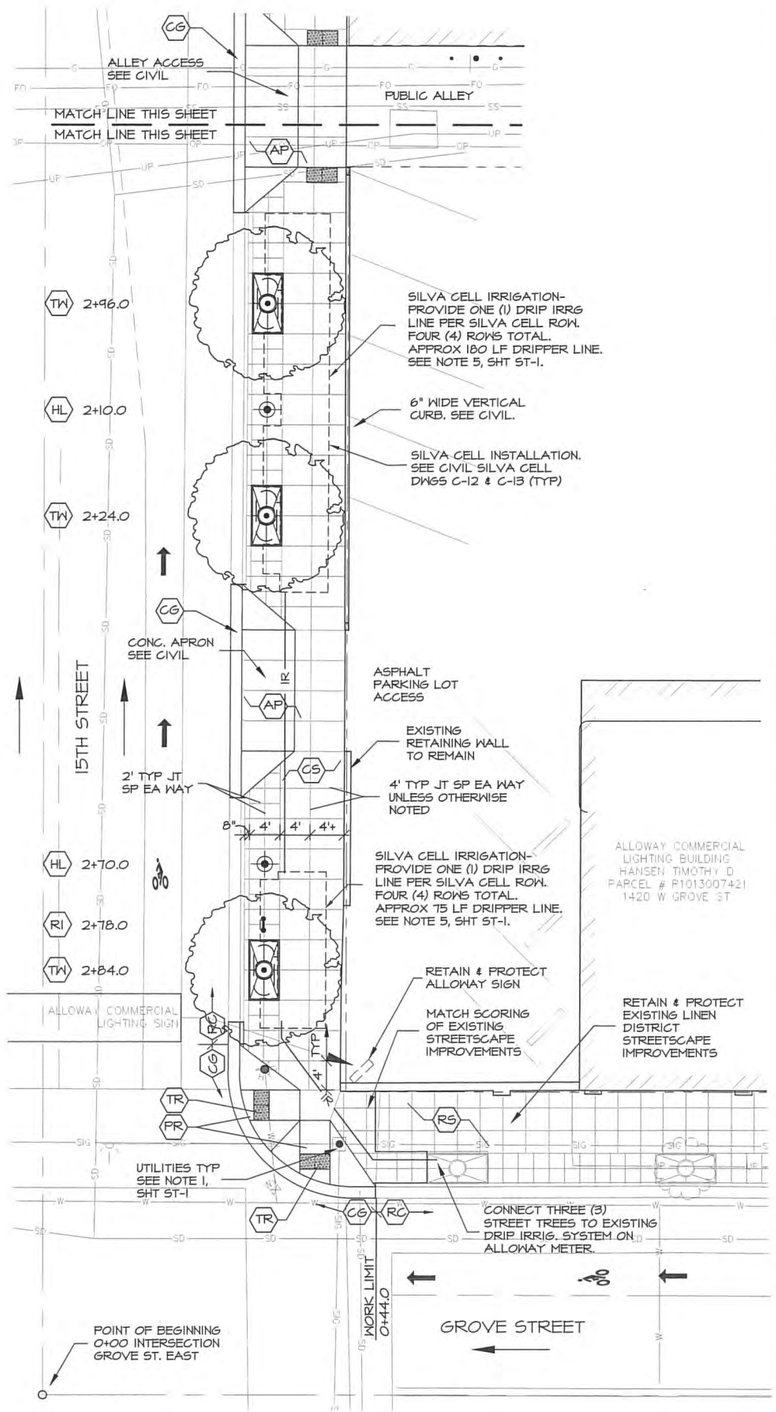
(REFER TO SHT ST-1)

SYMBOL	CALLOUT	DESCRIPTION
	AP	CONSTRUCT BRICK APPROACH WITH CONCRETE APRON
	BB	BRICK/CONCRETE STREETSCAPE STANDARD
	BI	4 FOOT BENCH.
	CG	CONSTRUCT CURB & GUTTER.
	CS	CONSTRUCT CONCRETE SIDEWALK.
	HL	HISTORIC LIGHT.
	LR	LITTER RECEPTACLE.
	PM	PARKING METER.
	PP	PRE-CAST PLANTERS.

SYMBOL	CALLOUT	DESCRIPTION
	PR	PEDESTRIAN RAMP.
	RI	BIKE RACK STANDARD. SURFACE MOUNT.
	R2	BIKE RACK STANDARD. DIRECT BURY.
	RC	RETAIN & PROTECT EXIST CURB & GUTTER.
	RS	RETAIN & PROTECT EXIST PAVING.
	TW	4'x8' TREE WELL.
	T	TREE PLANTING
	TR	TRUNCATED DOMES.
	VG	2'x2' VENT GRATE & FRAME.
IR		IRRIGATION SUPPLY.

NOTES

1. REFER TO SHT ST-1, ST-2, & ST-3 FOR STREETSCAPE NOTES AND DETAILS.



NORTH SCALE 1" = 10'

15TH & MAIN STREET

(Main St. to Grove St. - east side)

Issue Description	Date
PERMIT	4/8/15
1YR VENTS	4/21/15
BID SET	5/27/15

JENSENBELTS ASSOCIATES

Site Planning
Landscape Architecture

495 Main Street
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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO

CAPITAL CITY DEVELOPMENT CORPORATION

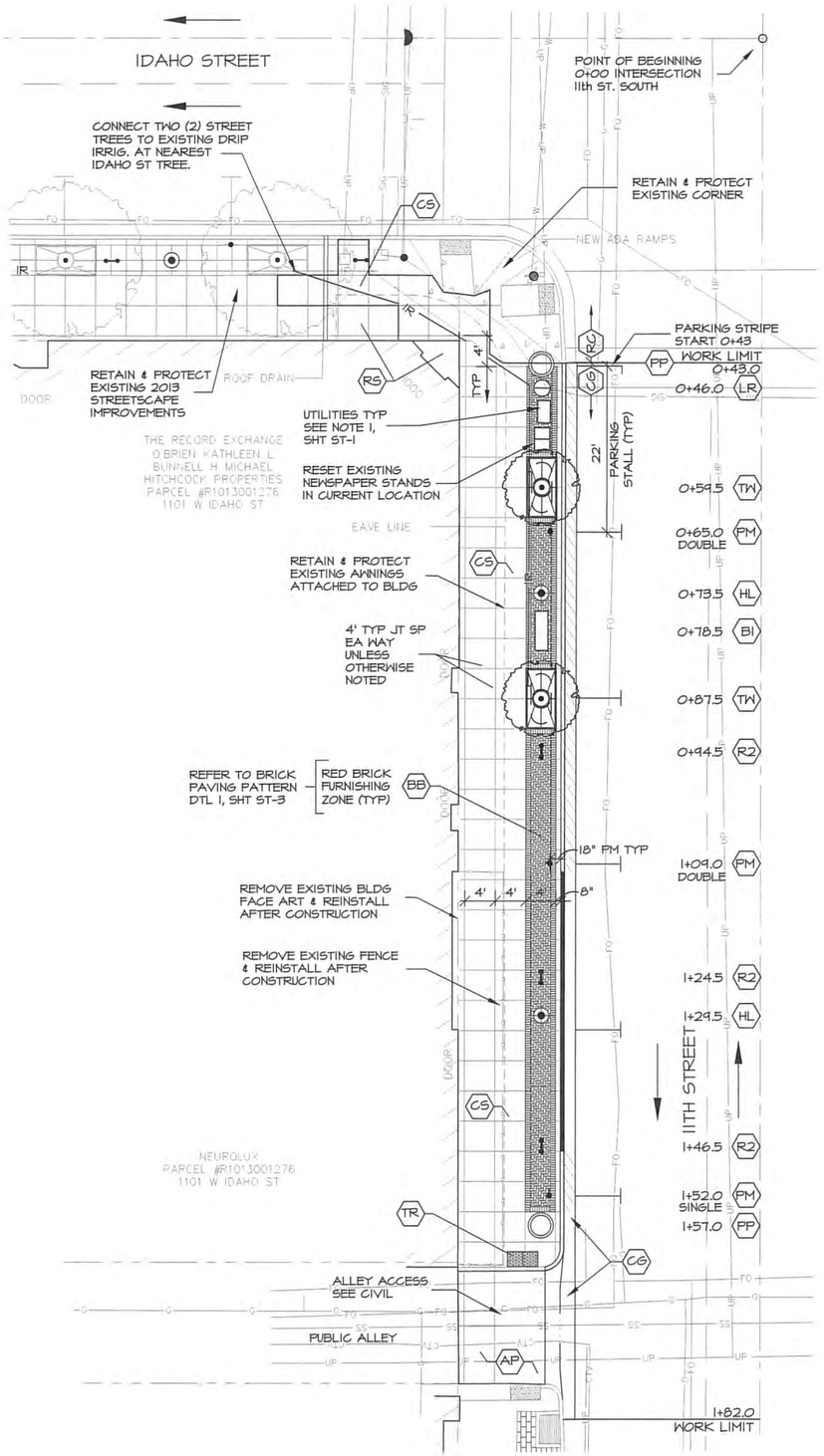
Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

Sheet Title: Streetscape Plan

Sheet Number: ST-6

Of Sheets



LEGEND OF CALLOUTS

(REFER TO SHT ST-1)

SYMBOL	CALLOUT	DESCRIPTION
	AP	CONSTRUCT BRICK APPROACH WITH CONCRETE APRON
	BB	BRICK/CONCRETE STREETSCAPE STANDARD
	BI	4 FOOT BENCH.
	CG	CONSTRUCT CURB & GUTTER.
	CS	CONSTRUCT CONCRETE SIDEWALK.
	HL	HISTORIC LIGHT.
	LR	LITTER RECEPTACLE.
	PM	PARKING METER.
	PP	PRE-CAST PLANTERS.
	PR	PEDESTRIAN RAMP.
	R1	BIKE RACK STANDARD. SURFACE MOUNT.
	R2	BIKE RACK STANDARD. DIRECT BURY.
	RC	RETAIN & PROTECT EXIST CURB & GUTTER.
	RS	RETAIN & PROTECT EXIST PAVING.
	TW	4'x8' TREE WELL.
	T	TREE PLANTING
	TR	TRUNCATED DOMES.
	VG	2'x2' VENT GRATE & FRAME.
—IR—		IRRIGATION SUPPLY.

NOTES

1. REFER TO SHT ST-1, ST-2, & ST-3 FOR STREETSCAPE NOTES AND DETAILS.

NORTH

SCALE 1" = 10'

11TH STREET

(Idaho St. south to alley - west side)

Issue Description	Date
PERMIT	4/8/15
BID SET	5/27/15

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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
KCS	KCS
Scale	As Shown

Sheet Title: Streetscape Plan

Sheet Number: ST-7

Of Sheets

SP-1450--UNDERGROUND SPRINKLER SYSTEM

GENERAL

Furnish and install underground sprinkler irrigation for supply to, and adequate irrigation of street trees and shrub plantings. New irrigation circuits with separate hookups, circuit extensions from existing circuits will be required. The systems will be connected to existing supply lines located in the sidewalk as well as new water meters in landscape. Do not disrupt existing water service without permission of or the adjacent owner. Winterize system at completion of season. Startup and make all adjustments at the beginning and through-out the following season to provide adequate water supply for healthy tree establishment. The work primarily consists of providing service supply connection, backflow device, automatic control, automatic valve, piping, and lateral circuit to the proposed trees.

Design requirement
Minimum water coverage: Tree Wells - Drip line as specified. Shrub Plantings - Drip line in rows as noted on plans.
Design pressures: Install pressure regulating equipment as necessary.

MATERIALS

PVC Pipe
Main supply underground: Schedule 40 PVC
Circuit supply line: Class 200 PVC
Sleeving (under all paved): Class 200 PVC
Risers: Flexible Poly-pipe in tree wells.
Fittings: Schedule 40 solvent welded. Threaded fittings as required.

Drip Line
NetaFin Techline CV with .4 gph emitters spaced 24 inches

Drip Control Zone
Hunter ICZ-101-25).

Automatic Control Device
Battery operated controller to be "Node" by Hunter or approved equal. Hookup and settings required for complete system operation.

Backflow Prevention Devices
Approved double check backflow device. 3/4" inch. Install per prevailing codes and ordinances.

Miscellaneous Drip Components
Drip Flushing Valve: NetaFin TLFV-1, two per zone. One each end of zone.

Valves
Manual Angle Drain Valves: One per zone. All brass; fixed handle; 150 psi rated. Install in traffic rated valve box.

Valve Boxes
Approved, traffic rated, with locking steel lid. Provide number and size as required for valve requirements and ease of operation. Provide 1.5 cubic foot drain rock.

CONSTRUCTION REQUIREMENTS

General
Install system to provide for adequate protection against freeze damage.
Install system in accordance with schematic design drawing.
Install system and components in strict accordance with manufacturer's recommendations.
Install provision for air blow winterization for protection of all system components.

Conduct of Work
It will be the Contractor's responsibility to verify these locations on the ground. Should the ditching intercept and damage any existing utilities, all further work within said area shall stop until the Landscape Architect is advised and can supervise repair.

Trenching
Trenching shall be executed in conformance with ISPWC Section 300--TRENCH EXCAVATION AND BACKFILL for Type I Trench Excavation. Trenches under paved surfaces shall be at least 24 inches deep for PVC lateral sprinkler lines downstream from automatic control valves (zone). All trenches must be straight and not have abrupt changes in grade. Unavoidable depth variations shall be approved by Landscape Architect.

Main Supply
Connect to building supply line, downstream of meter at location as shown on the drawings, with approved tapping device. Extend main supply line to valve box location. Install manual gate valve, manual drain valve, and backflow device. Install proposed automatic valve, filters, and other specified drip components.

Drain Valves
Install drain valves, one per circuit, outside foundation wall penetrations. Provide ¼ cubic yard gravel sump. Install PVC risers and traffic rated valve box(es) at finish sidewalk elevation.

PVC Pipe and Fittings
Due to the nature of PVC pipe and fittings, the Contractor shall exercise care in handling, loading, unloading, and storing to avoid damage. The pipe and fittings shall be stored under cover, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat, to prevent undue bending or concentrated external load at any point. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and the pipe is rejoined with a coupling.
PVC pipe ends shall be cut 90 degrees to the pipe length and cleaned of all cutting burrs prior to cementing. Use approved reaming tool. Pipe ends shall be wiped clean with a rag lightly wetted with PVC thinner. Apply cement with a light coat inside of the fitting and a heavier coat on outside of the pipe. Insert pipe into the fitting and give a quarter-turn to seat the cement. Wipe excess cement from outside of the pipe. Test pipe as indicated elsewhere in these Specifications. No backfilling will be permitted other than at the centers of pipe lengths until the pressure test is completed.

PVC pipe shall extend between tree wells uninterrupted by fittings. Locate pipe, tee, and other fittings within tree wells where practical. Protect pipe from damage where it penetrates the tree well. Provide PVC sleeving for all piping under paved surfaces.

Solvent welded joints shall be given at least 15 minutes set-up time before moving or handling. Pipe shall be partially center-loaded to prevent arching and slipping. No water shall be permitted in pipe until a period of at least 10 hours has elapsed for solvent weld setting and curing.

Sand bedding shall occur a minimum of 4 (four) inches in all directions around pipe.

Do backfilling when pipe is not in an expanded condition due to heat or pressure. Accomplish cooling of the pipe by operating the system for a short time before backfill, or by backfilling in the early part of the morning before the heat of the day.

Before pressure testing, soluble weld joints shall be given at least 24 hours curing time.

Great care must be taken to ensure that the inside of the pipe is absolutely clean. Any pipe ends not being worked on must be protected and not left open.

Drip Lines
Drip Line: Coil 20 Feet around each tree. Install at finish topsoil grade. Use Netafin staples to hold down. Flush all lines with full head of water, prior to installation of flush valves at end of circuit runs. Cover with gravel mulch to level of tree grate. Install drip line in rows for shrub beds and Silva Cell installation as noted on sheet ST-1

Flush Valves: Install flush valve at end of each drip lateral. Conceal in box within tree well.

Pressure Testing
Before backfilling, all components of the system shall be pressure tested. Cap all risers and water fill for testing of all supply lines. Tests are to be witnessed by the Owner's Representative. The Contractor shall give 48 hours of advance notice.

All system joints, connections, couplings, valves, hose bibs, and all other junction points, shall be left exposed until completion and acceptance of the pressure tests. The system shall be water filled, capped, and pressure-tested at 90 psi. To be acceptable, the system loses 0 psi in a 30-minute time span. Leaks shall be repaired and corrected.

The location, inspection, and testing provisions of these Specifications will be strictly adhered to. IF, for any reason, any part of the sprinkler system is backfilled before the Landscape Architect authorizes approved location, testing, or inspection, it must be completely uncovered and exposed until approved for backfilling.

Coverage Test
Install drip tubing and staple in place. Inspect for operation prior to gravel placement. Adjust for optimun performance. Review entire system operation with Owner's Representative prior to acceptance.

Backfilling
Backfill shall be executed in conformance with ISPWC Section 300--TRENCH EXCAVATION AND BACKFILL, Subsection 303, Pipe Bedding, for Type 1 Pipe Bedding, using sand.

Before complete backfilling, all underground appurtenances including risers, valves, backflow preventers, drain valves, etc., must remain exposed so that they can be viewed during testing. It is suggested that the Contractor partially backfill the pipe as it is laid, leaving all joints exposed; then complete backfilling later after flushing, pressure testing, inspection, and 'records drawing' location.

Final Acceptance
Upon completion and approval of all tests, final acceptance of the system will be contingent upon the Contractor instructing Owner personnel in system operation, providing signed and approved sprinkler/plumbing/ health/electrical permits as may be applicable in the area, as well as reproducible 'records drawings' and two binders of all catalog cuts/manufacturer's instructions/maintenance and operation information.

Guarantee in writing all materials, equipment and workmanship furnished to be free of all defects of workmanship and materials. Within two years after date of Substantial Completion repair or replace all defective parts or workmanship that may be found at no additional cost to Owner.

SP-1950--DRY LAID PAVING

DESCRIPTION

The work shall consist of furnishing all labor, services, and related items to install dry-laid brick pavers. The work shall also include furnishing and installing base rock where grades are being adjusted beneath existing pavers, crushed rock sub-base, bedding sand, and joint sand.

Paver Samples Submittal
Contractor shall provide and install for surface display enough brick pavers to cover 100 square feet of area proposed for use on the project if requested by the Architect. At the Contractor's option, this sample test may be done in an area that is part of the brick paving area rather than a completely separate area.

Test Results Submittals
Contractor shall submit test results on the following conditions and/or materials at the request of the Engineer:
- Sieve analysis of compacted crushed rock sub-base, bedding, and joint sand.
- Brick pavers in accordance with ASTM C67-80A, Sampling and Testing Brick and Structural Clay Tile for Weather Class SX, Traffic Type I Application PX.

Paving
Any settlement causing ponding of surface drainage and/or abrupt vertical edges greater than 1/8-inch occurring at paver edges within the one-year guarantee period will be considered to be caused by improper construction methods, and shall be corrected at no cost to the Owner. Contractor shall repair any subsequent damage caused by the settlement at no cost to the Owner.

MATERIALS -

Drylaid Pavers Aggregate crushed rock sub-base.

Size	3/4-inch Minus
3/4-inch	100
3/8-inch	65-80
No. 4	47-62
No. 50	8-18
No. 200 (incl. Wash)	3- 7

Bedding Material. Material used as bedding layer for the paver shall be well-graded, non-plastic sand, ASTM C33 or 5/16" clean crushed chip gravel.

Joint Sand. Joint sand for Drylaid Pavers shall be ASTM C33 washed sand or fine #70 silica sand joint filler.

The bedding and joint sand shall have gradations:

Sieve Size	Bedding Sand % Passing the Sieve
3/8-inch	100
No. 4	95-100
No. 8	85-100
No. 16	50- 85
No. 50	2-10
No. 100	5- 15

Brick Paver

Size/Shape. Rectangular pavers shall be 2-1/4" thick by 4" by 8" referred to as "Drylaid Brick Paver" on the drawings.

Manufacturer's Specifications. Paver shall be manufactured to ASTM C902-79A Standard Specification for pedestrian and light traffic paving brick, Weather Class SX, Traffic Type I, C410 Industrial Floor Brick and C279 Chemical Resistant Masonry Unit. The Contractor-furnished pavers shall be manufactured to the following specifications, and produced by the same manufacturer as the Owner-furnished pavers:

ASTM C67-80A Test Five (5) Paver Average	
Compressive Strength (psi)	12,000 min; 12,500 avg.
Modulus of Rupture (psi)	1,300
Absorption (24-hour submersion)	4% to 7% maximum
Abrasion Index (resistance)	0.11 maximum
Weight	0.5% maximum change in weight
Freeze Thaw	No visible damage
Efflorescence	None

Visual Inspection. Free of defects that interfere with proper placing of unit, strength or permanence of construction. Edges straight and true and colors acceptable to Engineer.

Color. Interlocking Brick Pavers shall be selected from No. 46 Medium Ironspot Blend (referred to as "Red"). Color shall conform exactly to the color samples on file in the Engineer's office.

Manufacturer. Endicott Clay Products Company; Fairbury, Nebraska; or equal.

CONSTRUCTION REQUIREMENTS-
Placement

Crushed Rock Base. Obtain approval of the subgrade from the Engineer prior to placing any base material on the subgrade. If weather conditions result in water saturation of the subgrade or base in excess of the optimum moisture content for those materials or is causing other unworkable conditions in the handling and compaction of the subgrade or base, the work shall be suspended as directed by the Engineer until satisfactory working conditions are restored. Placement of base materials or pavers shall not be continued if the subgrade or base is frozen or contains frost pockets. Work may be resumed in the placement of base materials or pavers after suspension due to adverse weather conditions when directed by the Engineer.

Place crushed rock base material to a minimum depth of 6 inches and in lifts not exceeding 6 inches in depth such that, when compacted to the specified density, the finished surface will conform to the grades and dimensions shown, with proper allowance for the paving. Compact to 95 percent of the maximum relative density.

The final result shall be an unyielding course, free from irregularities, with a smooth, tight and even surface, true to grade, line and cross section shown on Drawings. Variations in surface of the base course shall be a maximum of 1/2" in 10 feet. Variations greater than allowable shall be shaved off or filled in and compacted.

Maintenance. The Contractor shall maintain the surface of the crushed rock base until it is paved or until final acceptance. If ruts, soft spots or other damage occur before such time, the Contractor shall repair the surface at no extra cost or extension of time.

Bedding Material and Aggregate. Obtain approval of crushed rock sub-base from Engineer prior to placement of bedding material.

Initial layer of bedding material shall be spread evenly over the area to be paved to a depth of one inch. Thoroughly water-settle bedding material to crushed rock sub-base. After water-settlement and appropriate drying, add material where required and compact by approved mechanical method to specified lines and grades, less the paver thickness.

Final layer of bedding material shall be spread evenly over area to be paved to a depth after screeding of 1/2-inch. The height of the screed guides shall be set below the desired finish pavement surface a distance equal to paver thickness minus 1/4-inch to allow for settlement.

Level, to specified lines and grades, bedding materal with a screed. Under no circumstances should final bedding be compacted or walked upon after screeding.

Pavers

Obtain approval of bedding material placement prior to placement of pavers. Paver placement shall comply with manufacturer's recommendations as approved by the Engineer. Pavers shall be laid in approved pattern as shown on the drawings. The pavers shall be laid such that the desired pattern is maintained and the joints between the pavers do not exceed 1/8-inch.

Gaps at the edge of the paved surface fill with standard edge pieces or with pavers cut to fit. The pavers shall be cut to a straight even surface without cracks or chips. Pavers shall be notched to assure tight fit along steel edging as shown on drawings at points of staking.

Maintain continuous protection of surface from pedestrian traffic until joint sand application is complete.

Joint sand shall be evenly brushed over entire surface. Mechanically vibrate the surface with a steel plate vibrator. Provide protection with plywood sheeting. Brush sand over surface once again, and the brush away and remove excess sand until site is left clean.

After vibration the surface shall be true to grade, plus 1/4-inch, and shall not vary by more than 1/8-inch when tested with a 3-foot straight edge at any location on the surface.

Final Acceptance

Guarantee in writing all materials, equipment and workmanship furnished to be free of all defects of workmanship and materials. Within one year after date of Substantial Completion repair or replace all defective parts or workmanship that may be found at no additional cost to Owner.

SP-1951--LANDSCAPING

DESCRIPTION
This section covers all labor, materials, and equipment and all related items necessary for the treatment of subgrade, soil preparation, finish grading, soil treatment, planting soil mix installation, planting of trees, protection, maintenance, guarantee; and all related items required to complete the work shown on the Drawings. The work is to be done under the following criteria:
- The Contractor shall do all landscaping required to complete the work shown on the Drawings and/or Specifications.
- The Contractor shall make provision for supplying soil and all landscape material to the project area and other onsite locations, and providing all labor, without damage to buildings, walls, stairways, utilities, paved walkways, curbs, and paving.
- The Contractor shall employ the services of a Certified Arborist in the removal of street trees as indicated on the drawing.
- The Contractor shall provide a warranty for all materials and labor for two years from final acceptance. The Contractor shall replace all unhealthy or defective materials immediately upon notice during warranty period.

MATERIALS
Topsoil Mix---Natural Topsoil and Soil Amendment (Planting Bed and Lawn Areas only)
Contractor shall be responsible for the supply of all natural topsoil and soil amendments required for the performance of this contract and for determining the volume of natural topsoil and soil amendment required to fulfill his contract obligations.

Topsoil Mix (Planting Bed and Lawn Areas only). Topsoil mix shall be a two-way mix consisting of natural topsoil and soil amendments. Topsoil mix for tree wells shall be two-thirds natural topsoil and one-third soil amendment.

Natural Topsoil (Planting Bed and Lawn Areas only). For all topsoil mix, the natural topsoil shall be friable, fertile agricultural soil capable of sustaining vigorous plant growth. It shall be without admixture of subsoil; and free of stones, lumps, live parts, roots, and any other extraneous matter greater than one-inch diameter. Natural topsoil shall fall within the pH range of 6.0 to 8.0, and shall contain no less than one percent organic matter. Natural topsoil shall meet or be improved to meet mechanical requirements:

Component	Maximum Percentage
Sand	65
Silt	50
Clay	25

Contractor shall send a representative sample of the natural topsoil proposed for use on the project to an approved soil testing laboratory for a complete soil fertility report. The results shall be submitted to the Landscape Architect for approval. The Contractor shall be responsible for whatever soil additives may be necessary to bring the pH level, texture, and fertility to standards recommended by the laboratory.

Soil Amendment (Planting Bed and Lawn Areas only). For all topsoil mix, the soil amendment shall consist of 50 percent peat and 50 percent sand. Peat shall be a commercial product from a freshwater site, free from lumps, roots, and stones, absorbing at least four times its dry weight in water, with organic matter not less than 90 percent on a dry weight basis. The maximum moisture content at time of delivery shall be 65 percent by weight. Sand shall be clean, coarse, ungraded, meeting the requirements of ASTM C33 for fine aggregate.

Compost (Planting Bed and Lawn Areas only): NuEarth "Composed Soil Amenities" from Compost West (208) 467-1110 or equal.

Silva Cells Soil: No existing site soil shall be used for the Silva Cells planting mix soil. Soil testing shall be required on imported top soil and soil amendments per the requirements stated in the SECTION 32 94 56 PLANTING SOIL FOR SOIL CELLS provided by the Silva Cell Manufacturer. Unscreened Soil mix composition shall meet the required guidelines and installed per the Silva Cell Manufacturer's specification. In Silva Cells areas where stormwater treatment is included in the Silva Cell System, the Bioretention Soil Mix shall be use as specified in the Silva Cell Manufactures Soil Specifications.

Mulch
Mulch for tree wells shall be ½-inch minus clean washed pea gravel.
Mulch for planting beds shall be medium ground bark mulch, free of splinters, consistent in appearance, and shall contain no toxic substance detrimental to plant life.

Fertilizer
Fertilizer shall be standard commercial brand fertilizer, free-flowing and packaged in new, waterproof, non-overlaid bags clearly labeled as to weight, manufacturer, and content. Protect materials from deterioration during delivery and while stored at site. Fertilizer rates to be applied per manufacturers recommendations.
- Commercial fertilizer "A" for trees during planting; Transplanter Tablets, 21-10-5 type or equal.

Water
The Contractor shall make, at his expense, whatever arrangements are necessary to ensure an adequate supply of water to meet the needs of this Contract. He shall also furnish necessary hose, equipment, attachments, and accessories for the adequate irrigation of tree wells as may be required to complete the work specified. All costs for water incurred during the contract period shall be borne by the Contractor.

Anti-Desiccant
Anti-desiccant shall be "Wilt-Pruf," or approved equal, delivered in manufacturer's containers and used in accordance with manufacturer's recommendations.

Grass Material
Lawn sod: Provide strongly rooted sod, not less than 1 growing season old, and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant).Provide sod of uniform pad sizes with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected. Provide sod composed of eighty percent (80%) Kentucky Bluegrass containing fifty (50%) percent Baron, twenty-five (25%) percent Ram and twenty-five (25%) percent Majestic; twenty percent (20%) perennial Ryegrass; and shall contain no more than one (1%) percent other grass varieties.

Trees
Trees shall be caliper, balled and burlapped as noted on drawings. Limb to 6' minimum height above finish sidewalk grade, retaining a full, symmetrical tree canopy. Select specimens accordingly.

Root Barrier
Bioarrier Root Barrier or approved equal, 18" below subgrade on sidewalk side and 24" below subgrade on the curb side.

CONSTRUCTION REQUIREMENTS

Underground Utilities and Obstruction(s)
Verify location of all above and below surface utilities. Take special care to avoid fiber optic cable located near the curb on Main Street. Contractor shall be responsible for their protection. Notify Engineer of any conflict between proposed work and obstruction(s). Contractor must repair any and all damages resulting from work.

In the event that rock, hardpan, or underground construction work and/or obstructions are encountered in any plant pit excavation work to be done under this contract, the obstruction shall be removed to a depth of not less than 1.5 feet below the bottom of ball or roots when plant is properly set at the required grade. The contractor shall be paid for the removal of such rock, hardpan, or underground obstruction encountered at a unit price basis and agreed upon by a Change Order prior to commencement of work.

Subgrade
The Contractor shall be responsible for all cutting and filling necessary to ensure proper subgrade in accordance with ISPWC Specification Division 200---EARTHWORK.

Protection of Existing Street Trees to Remain. Existing trees to remain should be protected before any site/demolition begins. Tree protection area is defined as the area within the drip line diameter. Do not strip topsoil or grub under story within protection area. The tree under story to be removed shall be cut instead of pulling or grubbing. Leave the soil undisturbed. Prohibit earth stockpiling, material storage, vehicle parking and traffic within tree protection area. Prohibit cutting, breaking and skinning of branches and roots. All pruning of branches and roots is to be performed by the Arborist. Prohibit skinning and bruising of bark. No changes in grade should be made within the dripline of existing trees. Temporary irrigation is required for all remaining trees during construction. This system should provide adequate coverage and quantity of water during all phases of construction. Before the contractor leaves the site, all existing trees which have been damaged due to construction should be repaired/replaced at the expense of the contractor.

Excavation Around Existing Trees. Where trenching is required in the vicinity of the tree, proceed as follows: As the trench approaches the drip line of the tree, dig by hand until the roots encountered are two inches or larger in diameter. A similar trench is to be dug on the opposite of the tree and a tunnel augured under the tree between the two trenches at a depth of 4 feet. If auguring is impractical, continue digging by hand. Carefully dig under any roots over 4 inches in diameter. Do not cut main lateral roots or tap roots. Where excavating for new construction is required in soil containing the roots of the tree, hand excavate to minimize damage to root system. Use narrow line spading forks and comb soil to expose roots. Relocate roots back into backfill areas wherever possible. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If root relocation is not practical, cut roots approximately 3 inches back from new construction. Any digging or cutting that tears roots or disturbs soil beyond the grading limit is unacceptable. All roots larger than one inch must be cut by the Arborist.

Protection
All plants shall be transported to their final locations by the Contractor with care. Do not prune trees prior to delivery. Branches shall be tied back if necessary, but without damage to branches or shape, and bark protected with burlap bags to prevent damage from chafing by ropes and/or wires. Plants shall not be dragged along the ground or dropped, but properly placed providing complete protection for roots and branches.

Deliver trees after planting preparations are completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. The Contractor shall properly protect all plant materials against harm from wind, unusual weather, and the public until Final Acceptance. Maintenance of the planted areas shall include watering, weeding, and pruning, as well as replacement of any plants, which appear to be in distress.

Special planting techniques, defoliating, wilt proofing, or spray misting may be required should unusual or unseasonable planting conditions occur such as prolonged drought, hot weather, etc. Take all necessary precautions to protect work in progress, all property, persons, walks, curbs, pavement, and buildings from any damage that might be incurred arising from this Contract. Do not mix planting soil directly on paved surfaces.

Installation of Root Barrier: Install bioBarrier Root Barrier (or approved equal) per manufacture's recommendation that extends 18" below the subgrade on the sidewalk side and 24" below the subgrade on the curbside per detail where occurs.

Installation of Street Trees. Notify Landscape Architect 48 hours prior to planting first tree. Boise City Community Forester requires a tree planting demonstration at the first tree installation for landscape contractor to obtain planting method approval.

Positioning in Tree Well. Set all trees to center the trunk within the tree well to accommodate the grates.

Tree Well Excavation. Tree wells shall be excavated to the required dimensions as shown on the drawings and consistent with good horticultural practice. Clean all extraneous material from the tree well. If the Contractor encounters clay soil or any unusual condition, which may be detrimental to the new planting, he shall notify the Engineer immediately. Prior to backfilling, the tree wells shall be filled with 12 inches of water to determine drainage characteristics. Backfilling shall not proceed prior to approval of drainage characteristics by the Landscape Architect. Unsuitable drainage, if encountered, shall be corrected as Extra Work in accordance with the Specifications. The Contractor shall be paid for the corrections required on a unit price basis and agreed upon by a Change Order prior to commencement of work.

Tree Well Backfilling. Prior to tree planting, tree wells shall be backfilled to grade at which bottom of rootball will rest with specified topsoil mix. Backfill shall be placed dry in 6-inch lifts. Each lift shall be well tamped by foot.

Planting Tree Wells. The rootball crown shall be at finish soil grade. Backfill around rootball and thoroughly foot tamp. After planting and final setting, tree shall appear plumb. Water tree well thoroughly. Do not excavate, backfill, or tamp wet topsoil mix to avoid destroying soil texture. Mulch for tree wells shall be placed level and lightly tamped to support tree grate.

Pruning. After planting, Contractor shall prune trees to remove limbs that impede pedestrian and vehicular circulation, and irregular limbs that disrupt the overall planting pattern. Pruning shall be done under the direction of the Landscape Architect.

Tree Plumb. Contractor shall inspect all tree plantings weekly after installation and check for plumb. Trees not plumb shall be adjusted accordingly. Contractor shall be responsible for keeping trees plumb through guarantee period as described in these Specifications.

Planting Bed Soil Preparation. Loosen subgrade of planting bed areas to a minimum depth of 6 inches using a culti-mulcher or similar equipment. Remove stones measuring over 1½ inches in any dimension. Remove sticks, stones, rubbish, and other extraneous matter. Spread topsoil to required depth to meet lines, grades, and elevations shown, after light rolling and natural settlement (where required). Topsoil mix shall be 12 inches deep minimum in all planting bed areas. Add 1 ½ inches of specified compost over entire planting area and mix thoroughly into upper 9 inches of topsoil. Place approximately ½ of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil. Apply Pre-Emergent per manufacture's recommendation.

Sod Lawns Soil Preparation. Loosen subgrade of lawn areas stripped of topsoil to a minimum depth of 4 inches. Remove stones measuring over 1-1/2 inches in any dimension. Remove sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation. Spread topsoil mix to required depth to meet lines, grades, and elevations shown, after light rolling and natural settlement (where required). Topsoil shall be 6" deep minimum in all lawn areas. Add 1 inch of specified compost over entire area and mix thoroughly into upper 6 inches of topsoil.2. Place approximately ½ of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add recommended nutrients and fertilizers and mix into upper 4 inches of topsoil. Fine grade areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition. Restore lawn areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting. Maintain and protect all surfaces from wind and water erosion until final acceptance. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.

Sod Placement: Sod will be brought onto lawn areas by wheeled means with proper protection of sod beds. Sod layers shall be experienced, or if inexperienced, shall be constantly supervised by an experienced foreman. The Contractor shall insure that the base immediately ahead of sod layer is moist. Sod shall be laid tight with not gaps. Allowance shall be made for shrinkage. Lay sod with long edges perpendicular to primary slope. Lay to form a solid mass with tightly fitted joints. Butt ends and sides of strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work on boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work silted soil into minor cracks between pieces; remove excess to avoid smothering of adjacent grass. Sod shall be rolled with a two hundred (200) pound roller after installation to insure proper contact between soil and sod. Final rolling must provide a uniform surface. After final rolling, the sod lawn shall be mowed and watered. Approval of sod lawns shall be based on uniform, healthy and vigorous growth with no dry or dead spots. Add fertilizer "B" at the manufacturer's recommended application rate. Water sod thoroughly with a fine spray immediately after planting.

Sodded Lawn Establishment:The Contractor shall be responsible for first mowing, subsequent mowings and fertilizing of sod lawn areas until Final Acceptance of the project. Mowing shall be done by an approved "reel" type mower. Mower blades shall be set at two (2) inches high for all mowings. Subsequent fertilizing shall occur three to four weeks after installation. Apply fertilizer as per the Manufacturer's recommended application rate. Verify all methods of application. Contractor shall notify the Architect in writing that the fertilizer applications have occurred and on what dates.

Cleanup
Areas are to be kept clean during progress of work and until completion. Water, dirt, and rubbish are to be kept off of all paved areas. Remove surplus materials and rubbish from tree wells and shrub beds. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed. Wash clean all paved areas.

Maintenance
Begin landscape maintenance immediately after planting. Maintenance shall continue until Project Final Acceptance. Maintenance shall be the responsibility of the adjacent property owner upon satisfactory completion and acceptance of the work to begin warranty period.

Issue Description	Date
PERMIT	4/6/15
BID SET	5/27/15

JENSENBELTS ASSOCIATES
Site Planning
Landscape Architecture
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn KCS | Checked KCS
Scale As Shown

Sheet Title
Streetscape Specifications

Sheet Number
ST-8
Of Sheets

ELECTRICAL LEGEND

REFERENCE FIXTURE SCHEDULE FOR MOUNTING TYPE, MOUNTING HEIGHT, AND FIXTURE TYPE.

# PANEL NAME VOLTAGE PHASE	PANEL BOARD, SEE SCHEDULE FOR TYPE AND SIZE
##A #P	CIRCUIT BREAKER, SIZE AND POLES INDICATED
##A	FUSE, SIZE AND TYPE INDICATED, PROVIDE FUSE FOR EACH POLE
##A #P	INTERRUPTER SWITCH, SIZE AND POLES INDICATED
##A #P	FUSED SWITCH, SIZE/POLES AND FUSE SIZE INDICATED
M	METER AND BASE
N	NEUTRAL
GFP	GROUND FAULT PROTECTION
T	POLE MOUNTED TRANSFORMER(S)
	GROUND
S[x]	SWITCH, TYPE AS INDICATED. +46"AFF 2 DOUBLE POLE 3 3-WAY P PILOT LIGHT TO THERMAL OVERLOAD LV LOW VOLTAGE OS OCCUPANCY SENSOR - RE: OCC SENSOR SCHEDULE ON EG-2.1 OR# LOW VOLTAGE, MOMENTARY OVERRIDE - RE: CONTROL PANEL SCHEDULE ONE EG-2.1 a SUPERSCRIPT INDICATES LIGHTS TO BE SWITCHED TOGETHER
	DUPLEX CONVENIENCE OUTLET, +18" AFF UNO
	POLE LIGHT 1 HEAD WITH POLE
	TIME CLOCK
	PHOTO CONTROL CELL LOCATED 12" ABOVE ROOF FACING NORTH.
OS	OCCUPANCY SENSOR. PROVIDE RELAYS AND POWER PACKS AS REQUIRED. RE: OCC SENSOR SCHEDULE ON SHEET EG-2.1
	EMERGENCY EGRESS LIGHTING WITH OUT FIXTURE HEADS. CONNECT TO AN UNSWITCHED CONDUCTOR.
XXX(x)	INDICATES FIXTURE TYPE. REFER TO FIXTURE SCHEDULE. (SUBSCRIPT INDICATES LIGHTS TO BE SWITCHED TOGETHER)
C	CCTV CAMERA
	FLUORESCENT LIGHT FIXTURE.
	WALL MOUNTED LIGHT FIXTURE.
	CONNECTION POINT TO EQUIPMENT SPECIFIED.

NOTE: THIS IS A STANDARD LIST OF COMMONLY USED ELECTRICAL SYMBOLS. SOME OF THE SYMBOLS SHOWN MAY NOT HAVE BEEN USED IN THIS DRAWING PACKAGE. RE: 2/EG-3.1 FOR STANDARD MOUNTING HEIGHTS

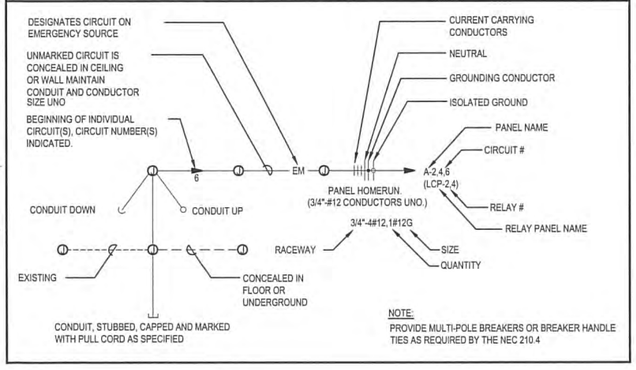
ELECTRICAL ABBREVIATIONS

A	AMPERES
AC	6" ABOVE BACKSPLASH
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AMPS INTERRUPTING CAPACITY
AT	AMP TRIP
AWG	AMERICAN WIRE GAUGE
C	CEILING MOUNTED
C	CONDUIT
CB	CIRCUIT BREAKER
CF	COMPACT FLUORESCENT
CKT	CIRCUIT
CO	CONDUIT ONLY, PROVIDE PULL-LINE
CT	CURRENT TRANSFORMER
CTL	CONTROL
(D)	DEMOLITION
DEMO	DEMOLITION
DET	DETAIL
E	EMERGENCY
(E)	EXISTING
EC	ELECTRICAL CONTRACTOR
F	FUSE
(F)	FUTURE
G/GND	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
HH	HAND HOLE
HID	HIGH INTENSITY DISCHARGE
HVAC	HEATING, VENTILATION, & AIR CONDITIONING
IPCO	IDAHO POWER COMPANY
J-BOX	JUNCTION BOX
KA	KILOAMP
KVA	KILO VOLT-AMP
KW	KILOWATT
MB	MAIN BREAKER
MBR	MAIN CIRCUIT BREAKER
MLO	MAIN LUGS ONLY
MTG	MOUNTING
N	NEUTRAL
(N)	NEW
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OH	OVERHEAD
P	POLES
PC	PHOTO-CONTROL
PVC	POLYVINYL CHLORIDE
PWR	POWER
RE:	REFERENCE
REC	RECEPTACLE
(R)	RELOCATED
SF	SQUARE FEET
(TYP.)	TYPICAL
UG	UNDERGROUND
UG S	UNDERGROUND SECONDARY BY IDAHO POWER CO.
U.N.O.	UNLESS NOTED OTHERWISE
V	VOLT
VA	VOLT-AMPERE
W	WATT
WP	WEATHER PROOF/NEMA 3R
XFMR	TRANSFORMER

PROVIDED/ PROVIDE BY INSTALLED/ INSTALL	PROVIDE AND INSTALL / PROVIDED AND INSTALLED BY / PROVIDE AND INSTALL

NOTE: THIS IS A STANDARD LIST OF COMMONLY USED ELECTRICAL ABBREVIATIONS. SOME OF THE ABBREVIATIONS SHOWN ABOVE MAY NOT BE USED IN THIS DRAWING PACKAGE.

CIRCUITING SYMBOLS



COMcheck Software Version 4.0.0

Exterior Lighting Compliance Certificate

Project Information

Energy Code:	2012 IECC
Project Title:	CCDC 2015 Streetscapes
Project Type:	Alteration
Exterior Lighting Zone	4 (High activity metropolitan commercial district)

Construction Site:

Owner/Agent:

Designer/Contractor:
Musgrove Engineering P.A.
234 S. Whisperwood Way
Boise, ID 83709
(208) 384-0585

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B X C)
Roadways (Driveway)	38318 ft2	0.13	Yes	4981
			Total Tradable Watts (a) =	4981
			Total Allowed Watts =	4981
			Total Allowed Supplemental Watts (b) =	1300

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.
(b) A supplemental allowance equal to 1300 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Roadways (Driveway 38318 ft2): Tradable Wattage				
LED 1: P1: Boise City Historic Pole: LED Roadway-Parking Unit 54W:	1	18	70	1260
			Total Tradable Proposed Watts =	1260

Exterior Lighting PASSES: Design 80% better than code

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 2012 IECC requirements in COMcheck Version 4.0.0 and to comply with the mandatory requirements listed in the Inspection Checklist.

NICK SCHAFER, P.E. — Name - Title
Signature
6/01/15 — Date

COMcheck Software Version 4.0.0

Inspection Checklist

Energy Code: 2012 IECC

Requirements: 0.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

2012 IECC	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR8][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

2012 IECC	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.2.4 [EL25][1]	Automatic lighting controls for exterior lighting installed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C405.6 [EL24][1]	Exterior grounds lighting over 100 W provides >60 lm/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

2012 IECC	Final Inspection	Complies?	Comments/Assumptions
C405.6.2 [FI19][1]	Exterior lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Exterior Lighting fixture schedule for values.*
C408.3 [FI48][1]	Lighting systems have been tested to ensure proper calibration, adjustment, programming, and operation.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
C406 [FI34][1]	Efficient HVAC performance, efficient lighting system, or on-site supply of renewable energy consistent with what is shown the approved plans.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

MUSGROVE ENGINEERING, P.A.
234 S. Whisperwood Way
Boise, Idaho 83709
208.384.0585
www.musgrove-pa.com
OVER 30 YEARS OF EXCELLENCE
project number: 15-075

Issue Description	Date
PERMIT	3/9/15
BID SET	5/27/15

PROFESSIONAL ENGINEER REGISTERED 12751 6/1/15 STATE OF IDAHO NICK SCHAFER

JENSENBELTS ASSOCIATES
Site Planning
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Boise, Idaho 83702
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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown

Sheet Title: Electrical Legend + Schedules

Sheet Number: EG-1

Of Sheets

SECTION 16010 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Provisions of this Section shall apply to all Sections of Division 16.

1.2 SCOPE OF WORK

A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 16 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation, including all accessories required for testing the system. It is the intent of the drawings and specifications that all systems be complete and ready for operation.

1.3 CODE COMPLIANCE

A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to, the following:

1.Occupational Safety and Health Act Standards (OSHA)

2.NFPA #70 - National Electric Code (NEC)

3.ADA Standards - Americans with Disabilities Act

4.ANSI/IEEE C-2 - National Electrical Safety Code

5.NECA - Standard of Installation

6.International Building Code

7.International Fire Code

8.International Energy Conservation Code

9.NFPA #72 - Fire Code

10.NFPA #101 - Life Safety Code

11.All other applicable Federal, State and local laws and regulations.

B. Work to be executed and inspected in accordance with local codes and ordinances. Permits, fees or charges for inspection or other services shall be paid for by the contractor. Local codes and ordinances are to be considered as minimum requirements and must be properly executed without expense to the owner; but do not relieve the contractor from work shown that exceeds minimum requirements.

1.4 CONDITIONS AT SITE

A. Visit to site is recommended of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Lines of other service that are damaged as a result of this work shall be promptly repaired at no expense to the owner to the complete satisfaction of the owner.

1.5 DRAWINGS AND SPECIFICATIONS

A. All drawings and all specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.

B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included in the bid. Check all information and report any apparent discrepancies before submitting bid.

C. Change to location, type, function, brand name, finish, etc., shall not be made without permission of engineer.

D. Some equipment is specifically designated on the drawings. It is not the intent to sole source any item unless explicitly stated. Items have been specified based upon design requirements. All bidders are encouraged to submit products for approval. Prior approval must be obtained as required by these contract documents. Bids submitted with non-approved items will be considered invalid and bidders will be held to provide approved materials at no additional cost to the owner. Submittals received by the engineer after award of contract on non-approved equipment will not be reviewed nor will they be returned.

E. Where conflicting direction is given within the specifications and drawings, the contractor shall include the most expensive option in the bid.

1.6 SAFETY AND INDEMNITY

A. Safety: The contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

B. No act, service, drawing review or construction review by the owner is intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction site.

1.7 CONSTRUCTION OBSERVATION BY THE ENGINEER

A. Prior to covering: any major portion of the materials installed under this section, notify the engineer so that an observation can be made. Notification shall be made at least three (3) working days in advance of the date the items will be covered.

1.8 PROJECT COMPLETION

A. Upon completion of all work and operational checks on all systems, the contractor shall request that a final construction observation be performed.

B. The engineer shall compile a punch list of items to be completed or corrected. The contractor shall notify the engineer upon completion of the items.

1.9 GUARANTEE

A. All work under this section shall be guaranteed in writing to be free of defective work, materials, or parts for a period of one (1) year, except lamps which shall be guaranteed for ninety (90) days, after final acceptance of the work under this contract or the period indicated under the Division 1 specifications whichever is longer.

B. Repair, revision or replacement of any and all defects, failure or inoperativeness shall be done by the contractor at no cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIAL APPROVAL

A. The design, manufacturer and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE or ANSI standards.

B. All materials must be new, unless noted otherwise, and UL listed. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency, which laboratory shall be acceptable to the owner and code enforcing agency.

2.2 SHOP DRAWINGS AND MATERIALS LIST

A. Submit shop drawings and materials lists as specified for review. Seven (7) copies, unless noted otherwise under Division 1, of submittals shall be presented to the architect/engineer.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Submit four (4) sets, unless noted otherwise under Division 1, of the Operation and Maintenance Manuals of all Division 16 equipment to architect/engineer.

2.4 RECORD DRAWINGS

A. Submit record drawings to owner.

2.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in a manner to prevent damage.

B. Protect equipment from weather and dampness.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.

B. Provide experienced foreman with a minimum of three years experience working on this type of building placed in charge of this work at all times.

3.2 COORDINATION

A. Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under trades that require electrical connections. Inform contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.

B. Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without the authorization of the owner, shall be at contractor's risk and expense.

C. Contractors installing lighting will be required to contact Boise City Public Works Inspection Section **48 hours** prior to the start of construction to receive a set of approved construction plans and to schedule the preliminary inspection prior to placing concrete or coving conduits. In addition, the electrical contractor is required to call **24 hours** in advance to schedule a final inspection by the Boise City Public Works Inspection Section after all work has been completed. Electrical Contractor must be present at final inspection. (To schedule Public Works inspection, phone 388-4725.

D. Developer or electrical contractor is required upon completion of all final inspections to notify Boise City Public Works Street Lighting Section (388-4719) when ready for power energizing to newly installed street lights. Provide the contractor's name, Subdivision name.

E. For design information or questions, contact Mike Hedge (208) 388-4719. All street lights shall be installed per NEC, ACHD codes for working within the public right-of-way, and Boise City Public Works street light standards.

3.3 MANUFACTURER'S INSTRUCTIONS

A. All installations are to be made in accordance with manufacturer's recommendations. A copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the engineer.

B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the engineer before starting work.

3.4 QUALITY ASSURANCE

A. The contractor shall insure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

B. Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and special systems.

3.5 CUTTING AND PATCHING

A. Perform all cutting and fittings required for work of this section in rough construction of the building.

B. All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

C. No joists, beams, girders or columns shall be cut by any contractor without obtaining written permission from the architect/engineer.

END OF SECTION 16010

SECTION 16060 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment to concrete encased electrode, metal underground water pipe, and effectively grounded metal frame of building.

B. Ground each separately-derived system neutral to nearest effectively grounded metal structural frame of building or point of service entrance ground.

C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground connectors, and plumbing systems.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 16120 - Conductors and Cables.

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure.

D. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

E. Bare Copper Conductors: Medium hard drawn copper conductor, stranded, sized as shown on the drawings.

F. Hardware: Bolts, nuts and washers shall be bronze, cadmium plated steel or other non-corrosive material, approved for the purpose.

G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

D. Below grade compression fittings: Thomas & Betts, Series 52000, 53000, and 54000 or equivalent.

E. Use connector and sealant approved for purpose on all below grade clamp or compression type connections.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 5/8 inch diameter, minimum length 8 feet.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NEC Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NEC are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1.Feeders and branch circuits.

2.Lighting circuits.

3.Receptacle circuits.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways bonded to outlet or equipment, sized per Section 250 of the NEC.

H. Provide green insulated ground conductor to exterior post light standards.

3.3INSTALLATION

A. Ground Rods: Where indicated, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1.Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2.Interconnect ground rods with grounding electrode conductors. Use exothermic welds, unless otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1.Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2.Make connections with clean, bare metal at points of contact.

3.Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4.Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5.Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 SYSTEM NEUTRAL GROUND

A. Ground the neutral conductor of each transformer or generator to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.

B. Ground generators or transformers with secondary voltage 600 volt or less as follows:

1.3 phase, 4 wire Wye connected: ground neutral point

C. For transformers 75 kVA or smaller with primary voltage 480 volt or less the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with NEC system ground conductor size.

3.6 EQUIPMENT GROUND

A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways or cable trays to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a grounding conductor in each raceway system. Equipment grounding conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size grounding conductors per NEC 250 unless otherwise shown on the drawings.

B. Install metal raceway couplings, fittings, and terminations secure and tight to ensure good grounding continuity. Provide grounding conductor sized per NEC through all raceway and conduit systems.

C. Lighting fixtures shall be securely connected to equipment grounding conductors. Outdoor lighting standards shall have a factory installed ground lug for terminating the grounding conductor.

D. Motors shall be connected to equipment ground conductors with a bolted solderless lug connection on the metal frame.

3.7 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Test ground system per Section 16040.

END OF SECTION 16060

SECTION 16113 - UNDER SLAB AND UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes under slab conduits and related electrical work.

PART 2 - PRODUCTS

2.1 CONDUIT

A. All shall be provided with fittings and accessories approved for the purpose. Refer to Section 16130.

2.2 BARE COPPER GROUND CONDUCTOR

A. Medium hard drawn copper conductor. # 4/0 AWG stranded (unless otherwise noted)

PART 3 - EXECUTION

3.1 GENERAL

A. Electrical system layouts indicated on the drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit.

3.2 CONDUIT INSTALLATION

A. Plastic conduit shall be installed on 2 inch sand base and covered by 2 inch sand back fill. Multiple runs shall maintain 3 inch minimum separation between runs. Plastic conduit shall not be installed in rock base.

B. Underground conduit entering building shall be provided with one 10 foot section of rigid steel conduit at point of penetration of foundation, footing or basement wall, with approximately equal lengths inside and outside building line. Ream the smaller inside diameter conduit smooth to prevent conductor damage.

C. Stagger conduit couplings by a minimum of 12 inches. All risers to grade shall be rigid steel.

D. All rigid steel conduits shall be encased in 3 inch minimum concrete envelope.

E. After completion of concrete encased duct bank, a 12 inch mandrel, ¼ inch less in diameter than a conduit, shall be pulled through each conduit.

F. Install 1/8 inch diameter pull line in each underground conduit.

G. Burial depths of conduits shall comply with the NEC (minimum).

H. Provide underground type plastic line markers: permanent, brightly colored, continuously printed plastic tape, intended for direct burial service, not less than 6 inches wide, reading "Caution Buried Electrical Line." Install continuous line markers located directly over buried line at 6 inches above top of conduit, during back filling operation.

3.3 CONCRETE DUCT BANK CONSTRUCTION

A. Provide plastic spacers at maximum 5'-0" centers to maintain 3 inch spacing between conduits.

B. Drive two reinforcing bars to anchor the conduits at 10'-0" on centers to prevent floating during concrete pour.

C. Provide one warning tape (see 3.2.H. above) for each 12 inch width of concrete duct bank.

END OF SECTION 16113

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

W. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

A. Submit shop drawings and product data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1.Wiring Devices:

a. Bryant Electric, Inc.

b. GE Company; GE Wiring Devices.

c. Hubbell, Inc.; Wiring Devices Div.

d. Leviton Manufacturing Co., Inc.

e. Pass & Seymour/Legrand; Wiring Devices Div.

f. Cooper Wiring Devices

g. Or approved equal.

2.2 RECEPTACLES

B. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter. White color

2.3 WALL PLATES

A. Single and combination types match corresponding wiring devices.

1.Weatherproof cover plate: While in use, gasketed, cast metal, hinged device covers.

2.Plate-Securing Screws: Metal with head color to match plate finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, vertically, with height as indicated.

F. Protect devices and assemblies during painting.

G. Install cover plates on switch, receptacle, and blank outlets.

3.2 IDENTIFICATION

A. Receptacles: Identify pedestal and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on the outside of the face plate for receptacles and on the inside of the face plate for switches; utilize durable wire markers or tags within all outlet boxes. Labels shall be Brother ½" TZ tape, black ink on clear, extra-strength adhesive tape, with size 18 text or engineer approved equal. Use matching label printer.

3.2 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Check each device to verify operation.

B. Test GFCI operation according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16521 - STREET LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Materials and installation of street lights.

1.2 RELATED SECTIONS

A. Section 301 - Trench Excavation.

B. Section 305 - Pipe Bedding.

C. Section 306 - Trench Backfill.

D. Section 307 - Street Cuts and Surface Repair

E. Section 308 - Boring and Jacking.

F. Section 703 - Cast-in-Place Concrete.

1.3 REFERENCES

A. National Electrical Code (NEC)

B. Idaho State Electrical Code.

C. City and Local Agency Codes.

1.4 SUBMITTALS

A. Submit shop drawings and manufacturers' cut sheets for materials to be installed under this Section.

B. Submit manufacturer's certification that materials meet or exceed specified requirements.

C. Submit manufacturers' installation instructions and maintain copy at the jobsite.

D. Submit warranty for all supplied materials and workmanship for a period of one year from final acceptance. The warranty must state that the products supplied were free of defects and suitable for the uses set forth in the Specifications.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record locations of constructed street lights and other encountered utilities in relation to existing permanent benchmarks.

B. Provide copy of record documents to owner prior to issuance of substantial completion. Show number and size of all components installed, including field wiring diagrams.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in accordance with the manufacturer's recommendations, to prevent shock, damage or excessive exposure to sunlight and weather.

1.7 GENERAL RESTRICTIONS

A. Contact local Utility Company for power location and installation requirements. All connections to a utility company facility shall be done by the utility.

B. No privately owned electrical systems, sprinkler irrigation systems, outlets, or area lighting will be allowed to connect to any public street light systems.

1.8 INSPECTIONS

A. Street light installation inspections will be required for the concrete base reinforcing for poles with concrete basis.

B. Visual confirmation of the backfill compaction around the pole base.

C. The conduit trench installation shall be inspected for the depth of trench and verification of the bedding suitability and placement.

D. The final inspection shall be to verify the pole is installed plumb and that the wiring in the pole and junction boxes conform to these specifications.

PART 2 - MATERIALS

2.1 GENERAL

A. All materials to have Underwriter Laboratories, Inc. seal of approval or meet the requirements of the National Electrical Manufacturer's Association, as appropriate.

B. Conform with the National Electrical Code and meet all local codes and requirements of the connecting utility.

2.2 JUNCTION BOXES

A. Junction boxes in driveways or roadways to be concrete with traffic rated lid.

B. Junction boxes in sidewalks and similar areas are to be concrete with steel lid.

C. Junction boxes in landscaped areas may be plastic or fiberglass.

D. All junction boxes to have a means to secure lid (i.e. bolt).

E. See Attachment A for approved products

2.3 FUSE HOLDERS

A. Insulated fuse holders (installed at the base of each metal or fiberglass pole), one per each 'hot' line.

1.Fuses for Boise City installation shall be fast acting - 100k RMS Amps-600VAC.

2.Fuse Holder and Insulating Boot: In-line, waterproof, SEC Model 1791-DF or SEC Model 1791-SF or approved substitution.

B. Insulated fuse holders (in fused junction box), one per each 'hot' line.

1.Fuses for Boise City installation shall be fast acting - 100k RMS Amps-600VAC.

2.Fuse Holder and Insulating Boot: In-line, waterproof, SEC Model 1791-DF or SEC Model 1791-SF or approved substitution.

2.4 CONDUCTOR

A. Underground wire.

1.Minimum standard for fuse system to power source: No.6 AWG copper, Type THWN - 600 volt, insulated.

2.Wires to be color-coated per NEC Code. Phase tape not acceptable.

B. Overhead Wire.

1.General: No. 6 AWG duplex with an ACSR neutral messenger.

2.Overhead installation only: Aluminum wire equivalent to copper wire will be allowed.

C. Pole wiring.

1.Between power source and the over-current protection source (located in the pole). Minimum No. 6 AWG THWN insulated copper wire.

2.Between over-current protection fuse and luminaire: Minimum No. 10 AWG THWN insulated copper wire.

2.5 CONDUIT

A. Above Ground

1.Galvanized metal conduit: UL approved

2.Schedule 40 PVC conduit: UL approved, 1 inch minimum diameter (ground level to disconnect box), ¾ inch minimum diameter (disconnect box to luminaire).

B. Underground Conduit

1.Schedule 40 PVC conduit: UL approved, 1 inch minimum diameter

2.Standard manufactured bends of no less than 45 degrees.

3.Locating wire only required for empty (spare) conduit.

2.6 PHOTOCELLS

A. Photoelectric (PE) controls to be twist lock type base with a label to mark installed and removed dates.

B. Outdoor Lighting Photoelectric Controls (OLPC) to be of a solid state crystal sensing type with inverted turn-on and turn-off design. Designed to turn-on at 3.0 (FC) 32.3 lux ± 20%, turn-off value will be 60% of the turn-on value (1.8 (FC) 19.4 lux± 20%). Designed to operate in 105 to 285 voltage range. Output control relay to have a 45 second time delay to prevent false turn-off from momentary brightness. Output relay rated at 1800 VA, 15 amps for all HID lamps with a failsafe (fail-on) design. OLPC to have a built-in MOV for lighting and transient/surge protection. OLPC to have secondary zenier diodes and transient filters. Circuit board to be properly coated to prevent corrosion. OLPC cover to be made of blue (ANSI color coding of 105-285 voltage range) hi-impact Noryl plastic, UL approved break resistant and flame retarding material. OLPC window to be acrylic with proper UV stabilizers to prevent discoloration. OLPC to conform to all IES street lighting standards and the ANSI C 136. 10 specification for twist look photo-control devices.

2.7 DISCONNECT BOXES (as required by governing agency)

A. Boxes shall conform to National Electrical Code (NEC), Article 370-15.

B. Overload protective devices allowed under NEC, Article 240.

C. Grounded as allowed in NEC Article 250-81 through Article 250-155.

D. Disconnect boxes are only required for overhead wiring.

2.12 HISTORICAL POLES

A. Historical style metal poles shall be true copies, approved by Boise City, Department of Public Works, of the original Old Boise Historical Pole. The new historical poles shall have the same surface texture and have the same Dark Green or Black Green color finish that matches the existing Historical poles in the Historical Lighting District. Metal poles shall have a powder coat finish in accordance with ASTM B-117.

B. Historical poles for the City of Boise shall be cast aluminum, in style and texture of the original Old Boise Historical Pole. Refer to Attachment A on sheet EG-3, and details on sheet E-9.

C. Color: To match existing poles, approved color mix for Valspar Anti-Rust gloss, oil enamel paint, base #4, #49437: mixture formula; 114-1Y29.44, 101-4Y42.9, 103-4Y14.55. Color designate for Antique is DGRG, for Continental it is RAL 6009.

D. Additional pole requirement for historic lights installed within the Capitol City Development Corporation (CCDC) shall be:

1.Poles shall be supplied with an electrical outlet as shown on details on sheet E-9.

2.Poles shall be supplied with a manufacturer's adaptor for installation of the approved banner arms.

2.14 CONCRETE POLE BASES

A. Concrete to be Class 3000 psi meeting the requirements of Section 703 - Cast-in-Place Concrete.

B. Steel Reinforcement to be deformed bar conforming to Section 702 - Concrete Reinforcement.

C. Pole anchors to be conform to requirements stipulated by pole manufacturer.

D. Base dimensions and construction shall conform to Standard Drawings SD-1109.

2.15 PREFABRICATED BASES

A. Prefabricated bases for historical poles will be allowed with approval of the local agency.

2.16 SERVICE PEDESTAL

A. Constructed of 12 gage zinc coated steel with hood and covers of 14 gauge zinc coated steel.

B. NEMA Type 3R rainproof enclosure with padlock hasp.

C. White powder coat finish in accordance with ASTM B-1117 or as directed by agency.

D. Complies with Caltrans Specification ES-2E.

E. 12 circuit copper bussed interior.

F. Plug-in breaker with each breaker having a minimum 30 amp, 2 pole rating.

G. Vandal-resistant enclosure with side-hinged door and dead front.

H. Factory wiring to be 600 volt rated copper with pressure type terminal required for (No. 8 through No. 2 AWG) wire.

I. Service cabinet rated 120/240 volt in either 100 amp or 200 amp main breaker

J. Equipped with a test switch to override photo electric control.

K. Cabinet supplied with a pad mount base available for concrete foundation installation.

L. Cabinet supplied with a meter base as recommended by the manufacturer.

M. See attachment A for approved products.

2.17 LIGHT FIXTURES

A. Fixture type and wattage as required by Boise City Public Works. See Attachment A on sheet EG-3 for approved products.

B. Medium cutoff reflector.

C. Fixtures to have I.E.S. full cutoff distribution reflector.

D. Acrylic or glass lens with internal refractor providing an E.I.S. Type III distribution.

PART 3 - WORKMANSHIP

3.1 EXAMINATIONS

A. Verify pole excavation location and depth matches plans prior to pole installation.

B. Verify that required clearances are available.

1.Transformers: 10 feet, front, 2 feet, side and back. See SD-1122.

2.Primary or Secondary Power Wires: 10 feet vertical and horizontal. See SD-1122.

3.Power Junction Box: 3 feet.

4.Curbing: 2 feet min., 6 feet max. from face of curb.

5.Structures: in accordance with National Electrical Safety Code.

6.Fire Hydrants: 10 feet side, 3 feet to the front.

7.Roadways: 18 feet vertical clearance for wires.

C. Examine pole and fixtures for defects or damage.

D. Verify pole, fixtures, electrical wiring, concrete, and materials delivered to the site meet the requirements of the Contract Documents.

E. Keep copies of electrical permits from the State of Idaho or the applicable municipality on-site.

3.2 JUNCTION BOX INSTALLATION

A. Install to locations as shown on the plans and at the power source (per SD-1117 or SD-1119). If not shown, space equidistant not to exceed 400 feet along straight conduit runs occur, at sharp bends, wire splices, or where direct burial and conduit junctions occur.

B. Excavate for box and aggregate foundation.

C. Install the junction box on 6 in. bed of compacted ¾-inch crushed aggregate base that extends 4 inches beyond the exterior of the box sides.

D. Do not install in any driveway or travel way unless box is fully rated for traffic.

E. Place top of junction box flush with surrounding ground, concrete, or pavement.

F. For historical street lights within the Capital City Development areas, an additional, parallel conduit shall be installed from the street light to the control cabinet to accommodate a separate circuit for the outlets on the poles.

CONTINUED ON SHEET EG-3

MUSGROVE ENGINEERING, P.A.
234 S. Whisperwood Way
Boise, Idaho 83709
208.384.0585
www.musgrovepa.com
OVER 30 YEARS OF EXCELLENCE
project number: 15-075

Issue Description	Date
PERMIT	3/9/15
BID SET	5/27/15

PROFESSIONAL ENGINEER
REGISTERED
12731
6/1/15
STATE OF IDAHO
NICK SCHAFER

JENSENBELTS ASSOCIATES
Site Planning
Landscape Architecture
495 Main Street
Boise, Idaho 83702
Ph. (208) 343-7175
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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn NJS Checked NJS
Scale As Shown
Sheet Title

Electrical Specifications

Sheet Number
EG-2
Of Sheets

CONTINUATION OF SECTION 16521 - STREET LIGHTING

3.3 WIRE OR CONDUCTORS

A. Splice underground wire only by means of approved connectors.

B. Splice underground wire only at pole bases or junction boxes.

C. Coil an additional 27 to 36 inches of wire at each connection point with transformer or junction box.

D. Attach overhead wire to the pole top and bond to the pole ground.

E. For overhead installation: Attach to the top of the new pole a complete coil of wire, long enough to span the distance between the new light and the power connection point.

3.4 CONDUIT INSTALLATION

A. Above Ground: All conduits required to be strapped, connected, or fastened to the pole at a minimum 5 feet interval.

B. Underground:
1. Raceways: Separate conduits by minimum of 3 inches.
2. Bedding: Surround conduit with a minimum of 3 inches clean sand.
3. Bends: Use standard manufactured elbows, bends, or couplings.
4. Kinking: Do not allow kinking or flattening of conduit if bending, use greatest radius possible.
5. Locating wires only **required** for conduit in which the conductors are not installed in conjunction with the conduit.
6. In landscaped areas: Minimum burial depth is 18 inches.
7. In travel way: Minimum burial depth is 30 inches or the requirement of the NEC, whichever is greater.
8. At installations where a street light is to be installed at a later date; seal ends of the conduit to prevent moisture and/or debris from entering.
9. For historical street lights within the Capital City Development areas, an additional, parallel conduit shall be installed from the street light to the control cabinet to accommodate a separate circuit for the outlets on the poles.

3.5 PHOTO CELL INSTALLATION

A. Mark date on every new or replacement installation.

B. Install to the manufacturer's recommendations.

C. Test Photoelectric Cell in the presence of the Engineer.

3.7 GROUNDING

A. Drive an 8 foot, 5/8-inch iron or steel rod 7.5 feet into the ground next to the pole.

B. Attach No. 6 AWG bare copper wire fastened to the pole at 5 foot intervals from the ground rod to the disconnect box, mast arm, and fixture.

C. Grounding per NEC, Article 250 and Standard Drawing SD-1121 - Grounding Details. Refer to details on sheet E-9, and City of Boise standard drawings BC SD-23 and BC SD-9.

3.8 CONCRETE POLE BASIS

A. Excavate pole base foundations to neat lines where soil conditions permit.

B. Place metal reinforcement and anchors per the Standard Drawings SD-1109.

C. Engineer to observe reinforcement and anchors prior to placement of concrete. Provide 48 hours' notice.

D. Place and finish concrete per ISPWC Division 700.

E. Concrete forming will be constructed per ISPWC Division 700.

F. Base dimensions and installation details shall conform to Standard Drawings SD-1109, SD-1116 and SD-1117.

G. Place and compact required backfill per ISPWC Division 300, Section 306.

3.9 POLE INSTALLATION

A. Excavate pole foundations to neat lines when soil conditions permit.

B. Refer to City of Boise standard drawing BC SD-23. Install metal poles in accordance with SD-11, SD-1109, SD-1116, SD-1117 and SD-1119.

C. Historical poles to be installed in accordance with standard drawings supplied by governing agency. Refer to City of Boise standard drawing BC SD-8 Historical Pole.

D. All poles shall be installed meeting the power company required clearances as shown on Standard Drawing SD-1112.

E. Street light connections to the power source shall be done by the power company.

F. Place and Compaction Requirements:
1. Backfill voids within 6 inches of the pole with crushed aggregate conforming to Section 802, Type I. Compact the backfill material to 95% maximum dry density. Use of sonotube forms to contain the imported material is acceptable, but is not required.
2. Backfill other disturbed soils in accordance with Section 204. Compact the backfill material to 92% maximum dry density.

G. Set pole plumb and true, mast arm and fixture perpendicular to public roadway or as approved by the Engineer.

H. Install prefabricated base, if applicable, per manufacturer's recommendations.

3.10 LUMINAIRE INSTALLATION

A. Install luminaire to manufacturer's recommendations.

B. Mark lamps with a month and year on the brass screw base to denote an installation date. See Standard Drawing SD-1120.

C. Test light in presence of the Engineer.

3.11 SERVICE PEDESTAL

A. Service pedestal shall be installed in accordance with Standard Drawing SD-1127.

B. Service pedestal wiring shall conform to the wiring diagrams shown on Standard Drawings SD-1125 and SD-1126, as directed by the Engineer. Service pedestals connected to historical street lights shall conform to SD-1126 with an additional meter connected to the electrical outlet circuit. See Attachment A on sheet EG-3 for approved products.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Use the following unit price as designated on the Bid Schedule. If required and not listed in the Bid Schedule, the following Bid Items are to be considered incidental to other Bid Items.

A. Street Light: Measurement and payment per each for the type and size of pole, mast arm and fixtures specified on the Contract Documents. Includes materials, labor, and equipment needed for the excavation, foundation, pole, internal pole wiring, wiring, conduit, mast arms, fixtures, junction boxes, disconnect boxes, fuses, luminaires, connections, cabinets, fittings, connections and all appurtenances not itemized in the Bid Schedule to produce a fully functional street light.
Contractor to include in bid all permit costs and costs to install and initiate electrical service.

1. Bid Schedule Payment Reference: 1102.4.1.A.1.
2. Bid Schedule Description: Street Light Type _____ ... per each (EA).

B. Payment for relocation of an existing light pole per each, all materials to be reused at new location:

1. Bid Schedule Payment Reference: 1102.4.1.B.1.
2. Bid Schedule Description: Relocate Street Light Type _____ ... per each (EA).

C. Payment per each for installing a light pole as an intermediate line pole.
1. Bid Schedule Payment Reference: 1102.4.1.C.1.
2. Bid Schedule Description: Intermediate Pole Type _____ ... per each (EA).

D. Install Wire or Conductors: Measurement and payment on a per horizontal linear foot basis for type (underground or above ground) of the wire following the alignment of the wire provided and installed from the centerline of the pole to power source, including connections in accordance with the Contract Documents.
1. Bid Schedule Payment Reference: 1102.4.1.D.1.
Bid Schedule Description: Wire/Conductor, Type _____ ... per linear foot (LF).

E. Install Conduit: Measurement and payment on a per horizontal linear foot basis for size of conduit installed from the centerline of the pole to power source, including connections in accordance with the Contract Documents.
1. Bid Schedule Payment Reference: 1102.4.1.E.1.
Bid Schedule Description: Conduit, Size _____ ... per linear foot (FT).

F. Junction Box: Measurement and payment on a per each basis for providing and installing junction box as required by the Contract Documents.
1. Bid Schedule Payment Reference: 1102.4.1.F.1.
Bid Schedule Description: Junction Box... per each (EA).

G. Service Pedestal: Measurement and payment on a per each basis for a service pedestal provided and installed in accordance with the Contract Documents. Including the cabinet, base, foundation, wiring, breakers, switches and all other work and materials necessary for a complete installation.
1. Bid Schedule Payment Reference: 1102.4.1.G.1.
Bid Schedule Description: Service Pedestal... per each (EA).

END OF SECTION 16521

SECTION 16800 - ELECTRICAL DEMOLITION AND REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes electrical demolition and repair. Work includes removal of obsolete wiring and electrical apparatus; relocation, reconnection or replacement of existing wiring affected by demolition or new construction; capping off concealed wiring abandoned due to demolition or new construction.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Conductors and Cables: Refer to Section 16120 - Conductors and Cables.

B. Raceways and Boxes: Refer to Section 16130 - Raceways and Boxes.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety. Completely remove all exposed traces, hardware, wiring and conduit systems to the source. All knockouts and holes shall be patched or plugged.

C. Contractor may re-use existing straight conduit runs and factory bends for conduits 2" and larger, provided that they are not damaged in any way and are installed in accordance with Section 16130.

D. Re-use of all other electrical apparatus and material is subject to approval by owner.

E. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

F. Remove demolished material for recycling as directed by owner.

G. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

H. Power outages shall be held to a minimum and coordinated with the owner. Contractor shall schedule outages during off-hours.

END OF SECTION 16800

ATTACHMENT A

GENERAL INFORMATION

All work shall conform to the requirements of the 2012 Edition of the Idaho Standards for Public Works Construction (ISPWC), the Supplementary Conditions and these Standard Revisions. Contractor shall become familiar with these documents to ensure full understanding of the requirements of this Project. Failure to do so does not relieve the Contractor of the duties, obligations and responsibilities addressed within those documents.

The Idaho State Electrical Board has determined that all street lights are to be provided with an external fuse disconnect, in a junction box between the power source and the street light pole. See attached standard drawings for connection requirements.

Street light installations inspections will be required for the concrete base reinforcing, the trench depth and bedding, and for the pole. Contact City of Boise at 384-3900 for inspections, 48 hour notice required. Contractor shall notify the City when street light is ready for turn on.

Attachment A lists approved products for Boise City street light installations. Contact Boise street light staff to seek approval for any substitute products.

The following is an approved part number listing for the City of Boise for public street lighting. All lighting projects within the City of Boise and the City of Boise Area of Impact shall use these products or an approved equal. Contact the City of Boise Public Works Street Light Office at (208) 388-4719 to seek approval for products not listed below (approved equal).

Part numbers listed for fixtures are basic and may not indicate the correct color or other features you need. Please verify part numbers with the vendors to ensure you are getting what you want to include the correct mounting hardware and color for your application.

Street light requirements including type, wattage, and pole height will be established by Boise Street Light staff.

HISTORICAL LIGHTS

HISTORIC LIGHT POLES:
Includes pole, capitol adapter (if applicable); FG-S duplex GFCI outlet; breakaway banner arm; lower eyelet 51" below banner arm; and custom hand hole cover w Boise City Logo.

Manufacturer	Part Number
Antique Street Lamps	PA B-120 12-6 3T3 CLD107811 EBB FG-S 601810 BAB25B4 BBA BI DGRG
Continental Pole & Lighting	ID20-FT12-ID21-BA, RAL 6009, Fluted-Cast Aluminum Pole w/ capitol integral to the pole (no capitol required)

HISTORIC LIGHT FIXTURES AND GLOBES:





Manufacturer	Part Number
Cooper Lighting LED Fixture	GRANVIL-50-E-1
Continental Pole & Lighting Glass Globe	ID21-C445 Type 3





Manufacturer	Part Number
Holophane LED Fixture (if ordered separately from glass globe)	GVDRETRO 60 5K AS A U 5
Holophane Globe (if ordered separately from LED fixture)	Granville GV3N Glass
Holophane Glass Globe and LED Fixture: if ordering both new LED fixture and glass globe	GVD 60 5K AS A DGRG 3 N N U

METERED SERVICE CABINETS

Metered service cabinets shall at a minimum contain all the items listed in the ISPWC Standard Drawings. All approved products below are 48 inches tall but vary in width.

SINGLE METER CABINETS

Manufacturer		Part Number
Milbank 24 inch wide	240 Volt	CP3B11113BWBOISE_
	277 Volt	CP3B1181FBWBOISE_
Milbank 16 inch wide	240 Volt	CP3B11113AWBOISE_
Myers 20 inch wide	240 Volt	MEUG20-M100-4CK-Boise

DUAL METER SERVICE CABINETS

Manufacturer		Part Number
Milbank 24 inch wide	240 Volt	CP3B22124BWBOISE_
Myers 24 inch wide	240 Volt	MEUG24-M100/M100-4CK-Boise

JUNCTION BOXES

SIDEWALK/ROADWAY AREA JUNCTION BOXES

Manufacturer	Use Location	Part Number
Idaho Precast Concrete	Sidewalks	S-40T
	Roadways / Driveways	S-40T ADA

LANDSCAPED/GRASS AREA JUNCTION BOXES

Manufacturer	Use Location	Part Number
Carson Industries	Landscaped Areas (9" Round)	Carson 910-10-4BE
	Landscaped Areas (19"x 14")	Carson 1419-12-4BE

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OVER 30 YEARS OF EXCELLENCE
project number: 15-075

Issue Description	Date
PERMIT	3/9/15
BID SET	5/27/15

PROFESSIONAL ENGINEER REGISTERED 12731 6/1/15 STATE OF IDAHO NICK SCHAFER

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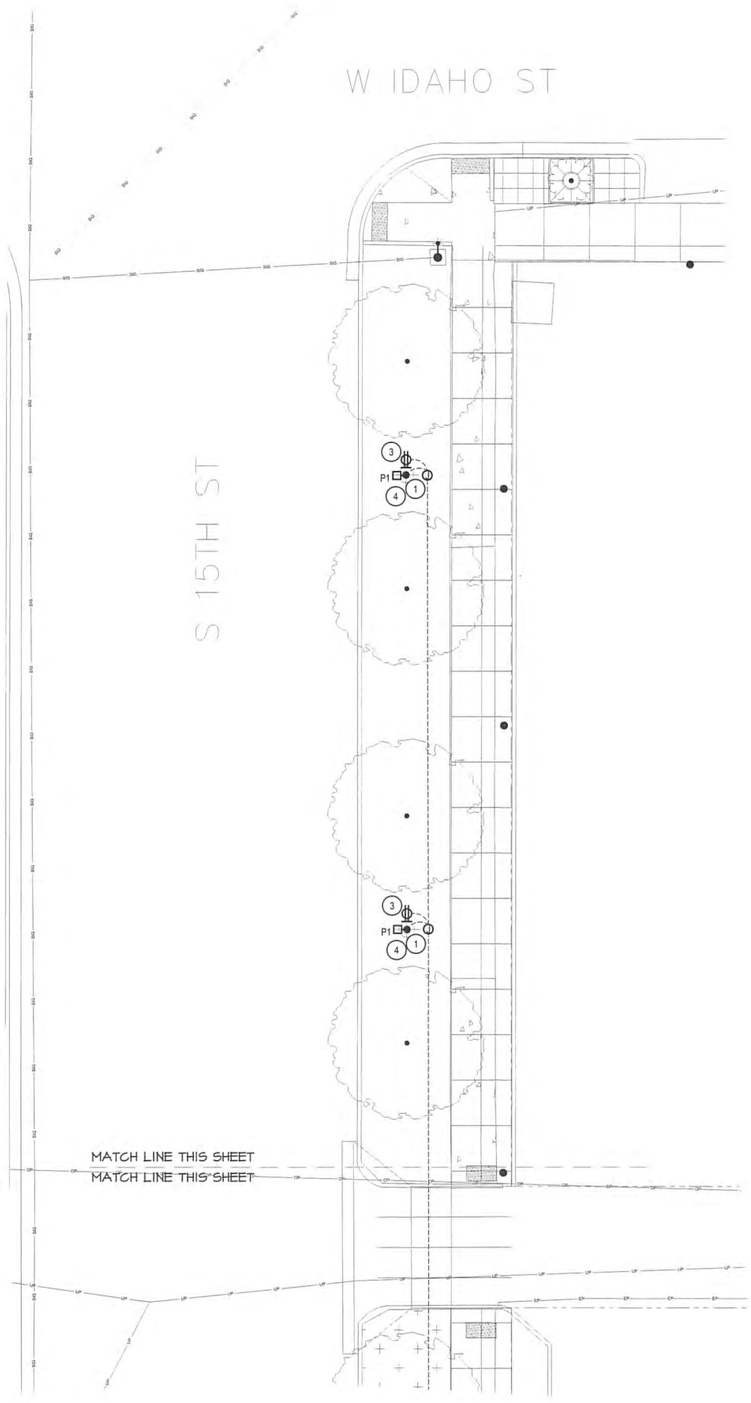
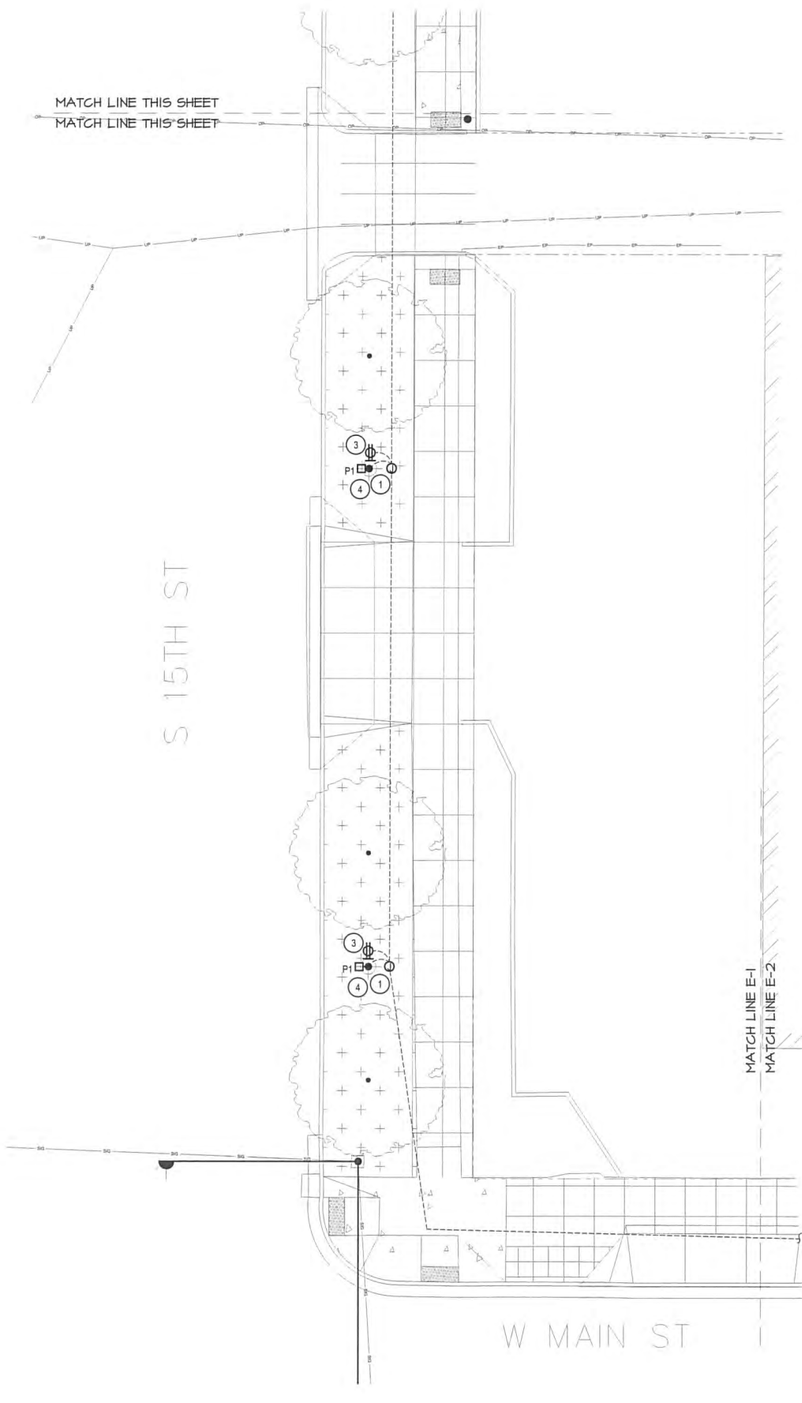
2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown
Sheet Title	Electrical Specifications

Sheet Number
EG-3
Of Sheets





NORTH SCALE 1" = 10'

ELECTRICAL PLAN 15TH & MAIN STREET
(Main St. to Idaho St. - east side)

GENERAL NOTES:

A. CONTRACTOR SHALL COORDINATE WITH AN UNDERGROUND LOCATING SERVICE PRIOR TO COMMENCING WORK. COORDINATE WITH OTHER SITE DISCIPLINES.

B. ROUTE CONDUITS IN COMMON TRENCH WHERE POSSIBLE RE: DETAIL 4/E-5.

C. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION.

D. SITE LIGHTING AND UTILITY EQUIPMENT SHOWN IN APPROXIMATE LOCATION. COORDINATE EXACT LOCATION WITH CIVIL DRAWINGS, PROPERTY LINES AND UTILITY COMPANIES PRIOR TO ROUGH-IN.

E. PROVIDE PULL-LINE AND METALLIC LOCATOR LINE IN ALL EMPTY CONDUITS.

F. ALL BRANCH CIRCUIT CONDUCTORS SHALL BE MINIMUM #6AWG (Cu), UNO. RE: DETAILS 1/E-5 AND 3/E-5.

G. ALL UNDERGROUND CONDUIT BETWEEN PULL BOXES SHALL BE A MINIMUM OF (2) 2" CONDUITS. PROVIDE A MINIMUM OF (2) 1" CONDUITS BETWEEN PULL BOXES AND THE ADJACENT LIGHT POLE. 18" MAX INSTALLATION OFFSET BEHIND BACK OF SIDEWALK. ALL CONDUITS INDICATED ON THIS PLAN ORE NEW, U.N.O.

H. FOR INFORMATION ON NEW POLES OF TYPE 'P1', SEE SPECIFICATIONS ON SHEETS EG-2 AND EG-3. RE: DETAILS 1/E-5 AND 2/E-5.

I. ALL EXISTING ACHD SIGNAL LIGHTS AND STREET LIGHTS SHALL REMAIN OPERATIONAL. MAINTAIN ALL CIRCUITS TO EXISTING EQUIPMENT UNLESS NOTED TO BE REMOVED.

J. ALL CONDUIT AND CONDUCTORS AND JUNCTION BOXES SHOWN ARE NEW UNLESS SPECIFICALLY NOTED OTHERWISE.

KEYED NOTES:

◯ SYMBOL USED FOR NOTE CALLOUT.

1. PROVIDE PULL BOX ADJACENT TO THE NEW LIGHT POLE. COORDINATE LOCATION WITH CIVIL ENGINEER PRIOR TO ROUGH-IN. REFER TO SPECIFICATIONS ON SHEETS EG-2 AND EG-3 AND DETAILS 1/E-5 AND 2/E-5.
2. REFER TO SHEET E-2 FOR CONTINUATION.
3. INSTALL RECEPTACLE ON POLE AND CONNECT TO RECEPTACLE CIRCUIT. REFER TO DETAIL 2/E-5.
4. INSTALL NEW CONDUCTORS IN NEW CONDUITS TO CONNECT NEW LIGHT FIXTURES AND RECEPTACLES. MAINTAIN EXISTING CONNECTIONS TO ALL EXISTING EQUIPMENT THAT IS REMAINING. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR A COMPLETE AND OPERATIONAL INSTALLATION. REFER TO CIVIL PLANS FOR CONDUIT LOCATION AND ROUTING.

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2015 WESTSIDE DISTRICT STREETSCAPES
BOISE, IDAHO
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown

Sheet Title: Electrical Plan - 15th Street

Sheet Number: E-1

Of Sheets

GENERAL NOTES:

A. CONTRACTOR SHALL COORDINATE WITH AN UNDERGROUND LOCATING SERVICE PRIOR TO COMMENCING WORK. COORDINATE WITH OTHER SITE DISCIPLINES.

B. ROUTE CONDUITS IN COMMON TRENCH WHERE POSSIBLE RE: DETAIL 4/E-5.

C. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION.

D. SITE LIGHTING AND UTILITY EQUIPMENT SHOWN IN APPROXIMATE LOCATION. COORDINATE EXACT LOCATION WITH CIVIL DRAWINGS, PROPERTY LINES AND UTILITY COMPANIES PRIOR TO ROUGH-IN.

E. PROVIDE PULL-LINE AND METALLIC LOCATOR LINE IN ALL EMPTY CONDUITS.

F. ALL BRANCH CIRCUIT CONDUCTORS SHALL BE MINIMUM #6AWG (Cu), UNO. RE: DETAILS 1/E-5 AND 3/E-5.

G. ALL UNDERGROUND CONDUIT BETWEEN PULL BOXES SHALL BE A MINIMUM OF (2) 2" CONDUITS. PROVIDE A MINIMUM OF (2) 1" CONDUITS BETWEEN PULL BOXES AND THE ADJACENT LIGHT POLE. 18" MAX INSTALLATION OFFSET BEHIND BACK OF SIDEWALK. ALL CONDUITS INDICATED ON THIS PLAN ORE NEW, U.N.O.

H. FOR INFORMATION ON NEW POLES OF TYPE 'P1', SEE SPECIFICATIONS ON SHEETS EG-2 AND EG-3. RE: DETAILS 1/E-5 AND 2/E-5.

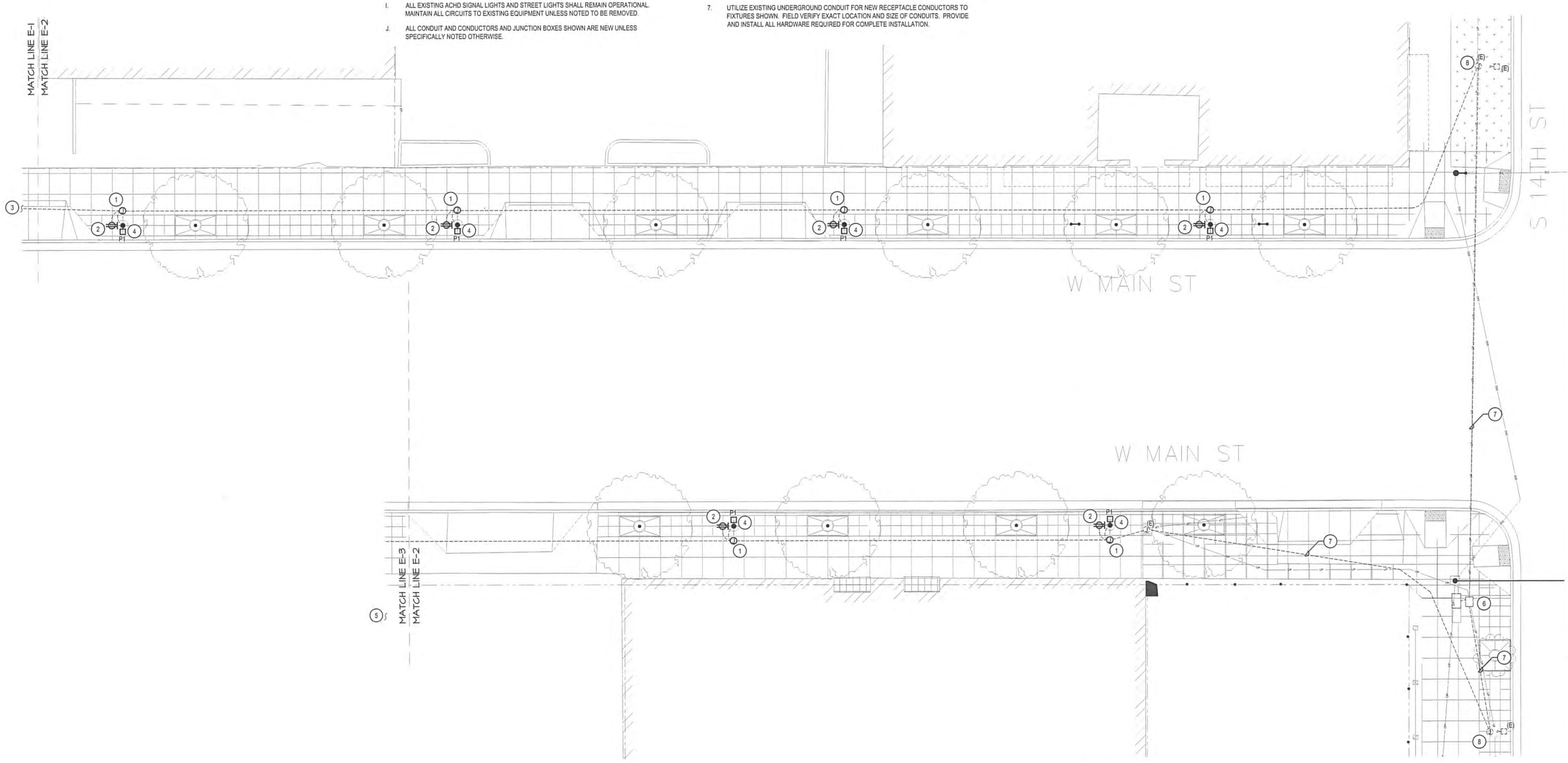
I. ALL EXISTING ACHD SIGNAL LIGHTS AND STREET LIGHTS SHALL REMAIN OPERATIONAL. MAINTAIN ALL CIRCUITS TO EXISTING EQUIPMENT UNLESS NOTED TO BE REMOVED.

J. ALL CONDUIT AND CONDUCTORS AND JUNCTION BOXES SHOWN ARE NEW UNLESS SPECIFICALLY NOTED OTHERWISE.

KEYED NOTES:

◯ SYMBOL USED FOR NOTE CALLOUT.

1. PROVIDE PULL BOX ADJACENT TO THE NEW LIGHT POLE. COORDINATE LOCATION WITH CIVIL ENGINEER PRIOR TO ROUGH-IN. REFER TO SPECIFICATIONS ON SHEETS EG-2 AND EG-3 AND DETAILS 1/E-5 AND 2/E-5.
2. INSTALL RECEPTACLE ON POLE AND CONNECT TO RECEPTACLE CIRCUIT. REFER TO DETAIL 2/E-5.
3. REFER TO SHEET E-1 FOR CONTINUATION.
4. INSTALL NEW CONDUCTORS IN NEW CONDUITS TO CONNECT NEW LIGHT FIXTURES AND RECEPTACLES. MAINTAIN EXISTING CONNECTIONS TO ALL EXISTING EQUIPMENT THAT IS REMAINING. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR A COMPLETE AND OPERATIONAL INSTALLATION. REFER TO CIVIL PLANS FOR CONDUIT LOCATION AND ROUTING.
5. REFER TO SHEET E-3 FOR CONTINUATION.
6. EXISTING METER PEDESTAL WITH SPARE RECEPTACLE AND LIGHTING CIRCUITS AVAILABLE. PROVIDE AND INSTALL NEW BREAKERS AS REQUIRED. PROVIDE CONDUIT CONDUCTORS AND OTHER HARDWARE AS REQUIRED TO CONNECT NEW FIXTURES. MARK CIRCUITS USED WITH LOCATION FED FROM CIRCUIT FOR FUTURE REFERENCE.
7. UTILIZE EXISTING UNDERGROUND CONDUIT FOR NEW RECEPTACLE CONDUCTORS TO FIXTURES SHOWN. FIELD VERIFY EXACT LOCATION AND SIZE OF CONDUITS. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR COMPLETE INSTALLATION.
8. EXTEND EXISTING LIGHTING CONDUCTORS FROM THIS JUNCTION BOX TO NEW FIXTURES AS SHOWN. ROUTE NEW RECEPTACLE CONDUCTORS FROM EXISTING BREAKER CABINET THROUGH THIS BOX AND ON TO NEW FIXTURES AS SHOWN. PROVIDE AND INSTALL NEW CONDUIT AND CONDUCTORS AS REQUIRED.



ELECTRICAL PLAN MAIN STREET - EAST END
(15th St. to 14th St.)

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BID SET	5/27/15

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2015 WESTSIDE DISTRICT STREETSCAPES
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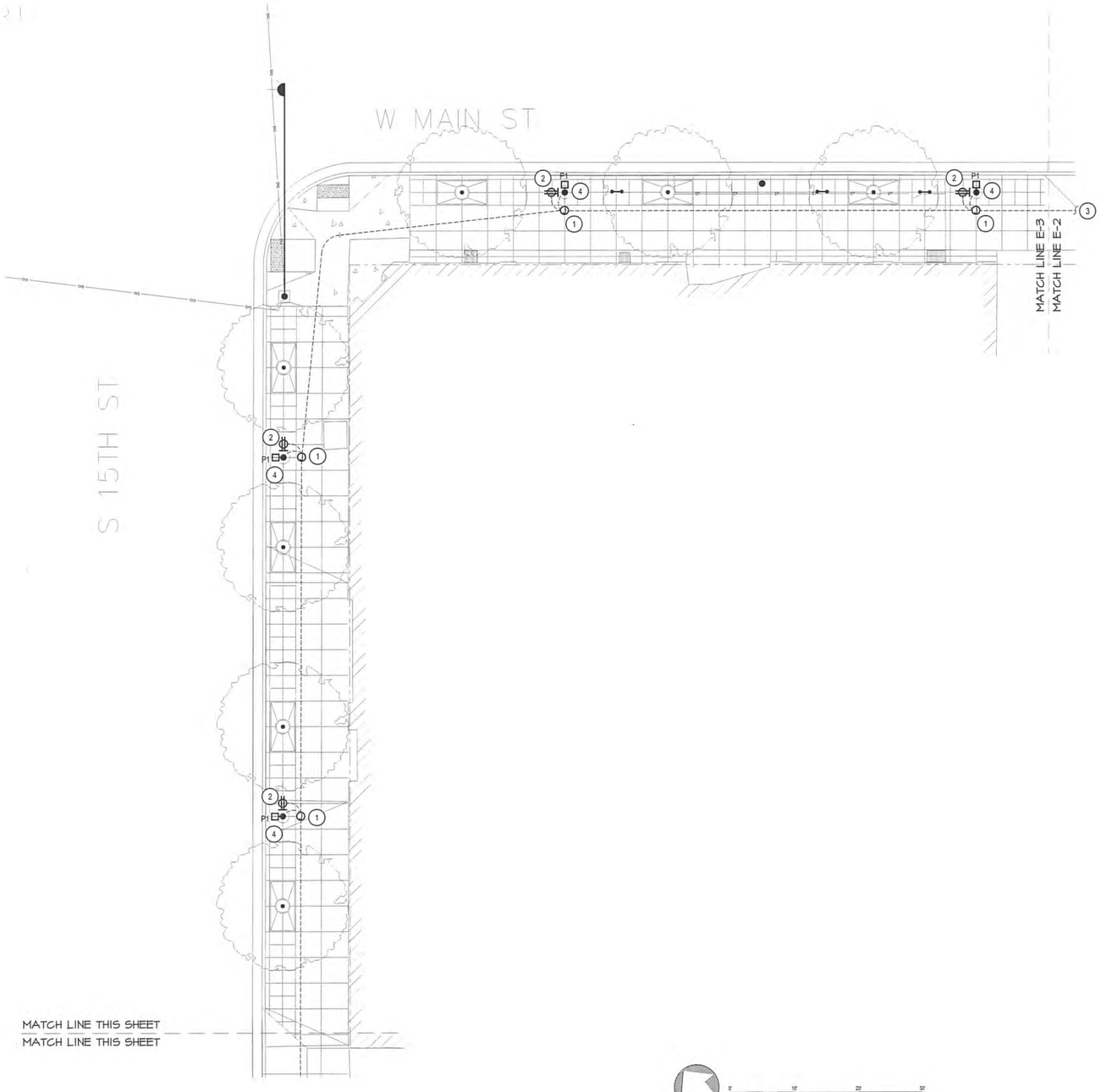
CAPITAL CITY DEVELOPMENT CORPORATION

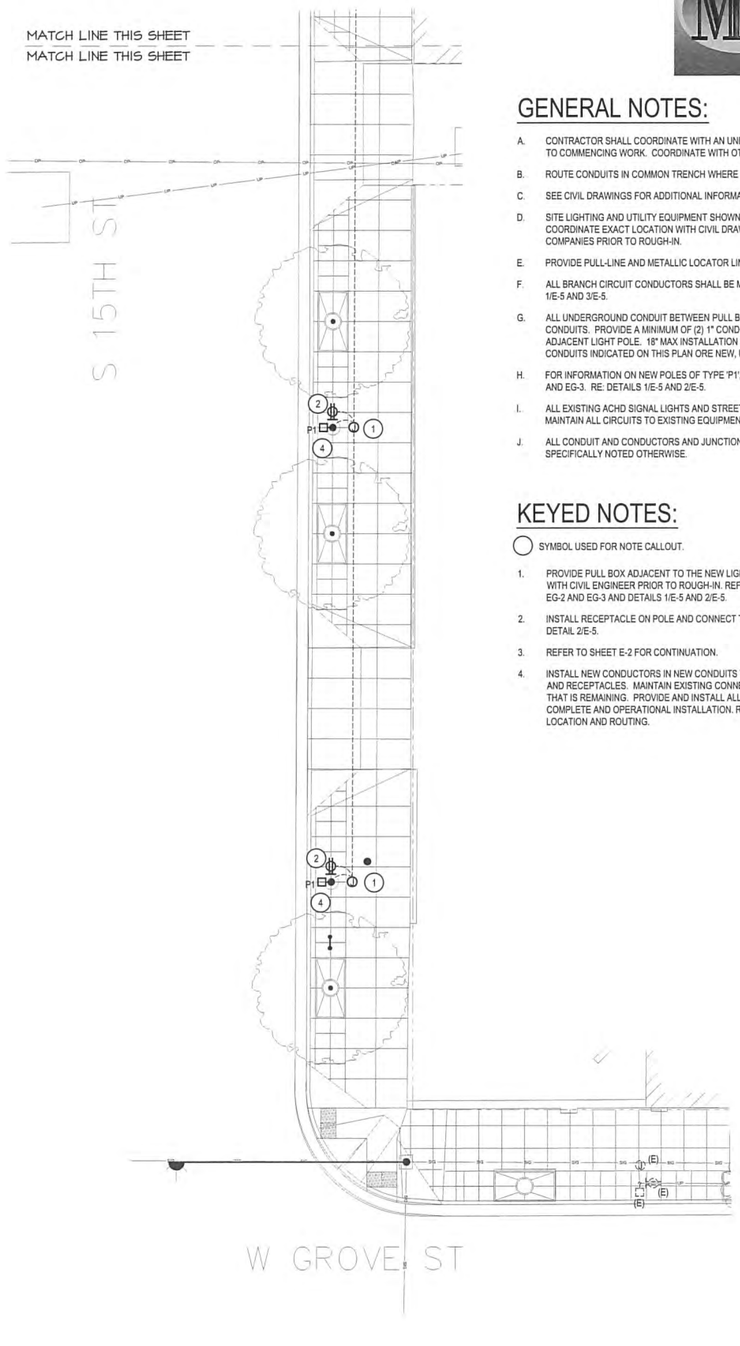
Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown

Sheet Title: Electrical Plan -Main St East End

Sheet Number: E-2
Of Sheets





NORTH SCALE 1" = 10'

ELECTRICAL PLAN 15th & MAIN STREET

(Main St. to Grove St. - east side)

GENERAL NOTES:

A. CONTRACTOR SHALL COORDINATE WITH AN UNDERGROUND LOCATING SERVICE PRIOR TO COMMENCING WORK. COORDINATE WITH OTHER SITE DISCIPLINES.

B. ROUTE CONDUITS IN COMMON TRENCH WHERE POSSIBLE RE: DETAIL 4/E-5.

C. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION.

D. SITE LIGHTING AND UTILITY EQUIPMENT SHOWN IN APPROXIMATE LOCATION. COORDINATE EXACT LOCATION WITH CIVIL DRAWINGS, PROPERTY LINES AND UTILITY COMPANIES PRIOR TO ROUGH-IN.

E. PROVIDE PULL-LINE AND METALLIC LOCATOR LINE IN ALL EMPTY CONDUITS.

F. ALL BRANCH CIRCUIT CONDUCTORS SHALL BE MINIMUM #6AWG (Cu), UNO. RE: DETAILS 1/E-5 AND 3/E-5.

G. ALL UNDERGROUND CONDUIT BETWEEN PULL BOXES SHALL BE A MINIMUM OF (2) 2" CONDUITS. PROVIDE A MINIMUM OF (2) 1" CONDUITS BETWEEN PULL BOXES AND THE ADJACENT LIGHT POLE. 18" MAX INSTALLATION OFFSET BEHIND BACK OF SIDEWALK. ALL CONDUITS INDICATED ON THIS PLAN ORE NEW, U.N.O.

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J. ALL CONDUIT AND CONDUCTORS AND JUNCTION BOXES SHOWN ARE NEW UNLESS SPECIFICALLY NOTED OTHERWISE.

KEYED NOTES:

◯ SYMBOL USED FOR NOTE CALLOUT.

1. PROVIDE PULL BOX ADJACENT TO THE NEW LIGHT POLE. COORDINATE LOCATION WITH CIVIL ENGINEER PRIOR TO ROUGH-IN. REFER TO SPECIFICATIONS ON SHEETS EG-2 AND EG-3 AND DETAILS 1/E-5 AND 2/E-5.
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3. REFER TO SHEET E-2 FOR CONTINUATION.
4. INSTALL NEW CONDUCTORS IN NEW CONDUITS TO CONNECT NEW LIGHT FIXTURES AND RECEPTACLES. MAINTAIN EXISTING CONNECTIONS TO ALL EXISTING EQUIPMENT THAT IS REMAINING. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR A COMPLETE AND OPERATIONAL INSTALLATION. REFER TO CIVIL PLANS FOR CONDUIT LOCATION AND ROUTING.

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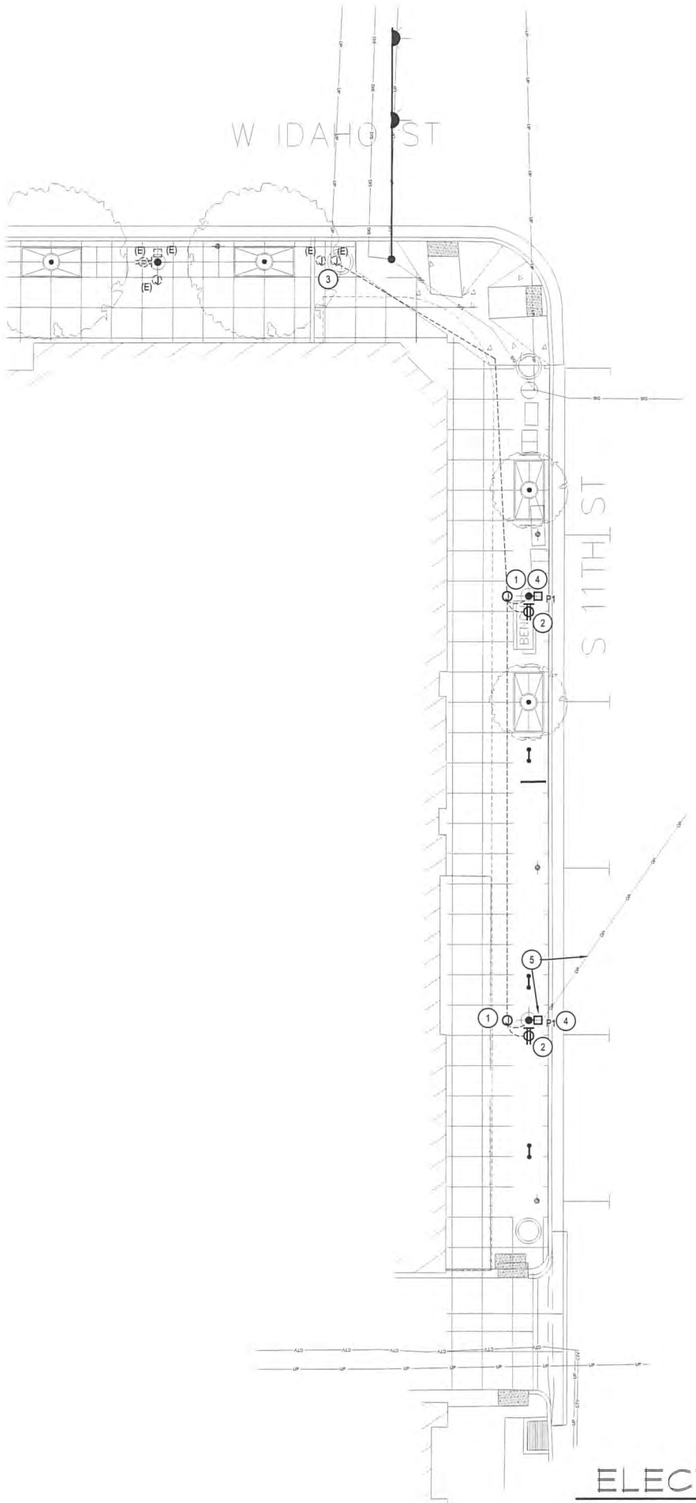
CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown

Sheet Title
Electrical Plan -15th and Main Main to Grove

Sheet Number
E-3
Of Sheets



NORTH

SCALE 1" = 10'

ELECTRICAL PLAN 11th STREET

(Idaho St. south to alley - west side)

GENERAL NOTES:

A. CONTRACTOR SHALL COORDINATE WITH AN UNDERGROUND LOCATING SERVICE PRIOR TO COMMENCING WORK. COORDINATE WITH OTHER SITE DISCIPLINES.

B. ROUTE CONDUITS IN COMMON TRENCH WHERE POSSIBLE RE: DETAIL 4/E-5.

C. SEE CIVIL DRAWINGS FOR ADDITIONAL INFORMATION.

D. SITE LIGHTING AND UTILITY EQUIPMENT SHOWN IN APPROXIMATE LOCATION. COORDINATE EXACT LOCATION WITH CIVIL DRAWINGS, PROPERTY LINES AND UTILITY COMPANIES PRIOR TO ROUGH-IN.

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H. FOR INFORMATION ON NEW POLES OF TYPE 'P1', SEE SPECIFICATIONS ON SHEETS EG-2 AND EG-3. RE: DETAILS 1/E-5 AND 2/E-5.

I. ALL EXISTING ACHD SIGNAL LIGHTS AND STREET LIGHTS SHALL REMAIN OPERATIONAL. MAINTAIN ALL CIRCUITS TO EXISTING EQUIPMENT UNLESS NOTED TO BE REMOVED.

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KEYED NOTES:

◯ SYMBOL USED FOR NOTE CALLOUT.

1. PROVIDE PULL BOX ADJACENT TO THE NEW LIGHT POLE. COORDINATE LOCATION WITH CIVIL ENGINEER PRIOR TO ROUGH-IN. REFER TO SPECIFICATIONS ON SHEETS EG-2 AND EG-3 AND DETAILS 1/E-5 AND 2/E-5.
2. INSTALL RECEPTACLE ON POLE AND CONNECT TO RECEPTACLE CIRCUIT. REFER TO DETAIL 2/E-5.
3. INTERCEPT EXISTING RECEPTACLE AND LIGHTING CIRCUIT AT EXISTING JUNCTION BOX AND EXTEND TO NEW FIXTURES AS SHOWN . FIELD VERIFY EXACT LOCATION OF JUNCTION BOX AND CIRCUITS. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR A COMPLETE INSTALLATION.
4. INSTALL NEW CONDUCTORS IN NEW CONDUITS TO CONNECT NEW LIGHT FIXTURES AND RECEPTACLES. MAINTAIN EXISTING CONNECTIONS TO ALL EXISTING EQUIPMENT THAT IS REMAINING. PROVIDE AND INSTALL ALL HARDWARE REQUIRED FOR A COMPLETE AND OPERATIONAL INSTALLATION. REFER TO CIVIL PLANS FOR CONDUIT LOCATION AND ROUTING.
5. REMOVE EXISTING STREET LIGHT POLE, LIGHT FIXTURE AND OVERHEAD FEED TO POLE. RETURN POLE AND FIXTURE TO BOISE CITY. MAINTAIN POWER TO ALL OTHER FIXTURES AND EQUIPMENT FED FROM OVERHEAD LINE.

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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO

CAPITAL CITY DEVELOPMENT CORPORATION

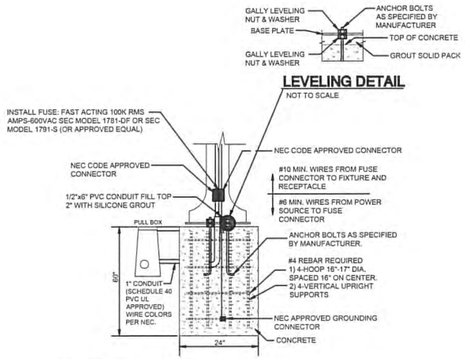
Job Number: 1509

Drawn	Checked
NJS	NJS
Scale	As Shown

Sheet Title: Electrical Plan -11th St. West Side

Sheet Number: E-4

Of Sheets

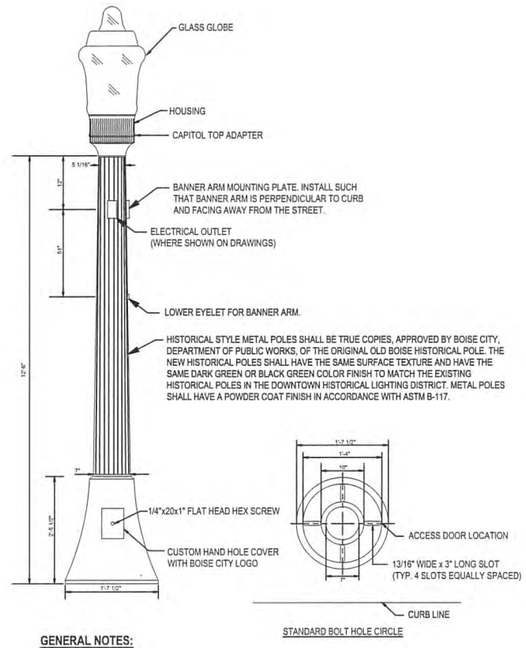


GENERAL NOTES:

A. REFER TO SPECIFICATIONS FOR ADDITIONAL DESCRIPTION AND MANUFACTURER'S PART NUMBER FOR POLE, LUMINAIRE, HOUSING, ETC.

B. GROUND ROD MAY BE PLACED IN LIEU OF CONNECTION TO REBAR CAGE. FOR GROUNDING DETAILS, RE: ISPWC STANDARD DRAWING SD-1109

1 HISTORICAL STREET LIGHT POLE BASE DETAIL
NTS

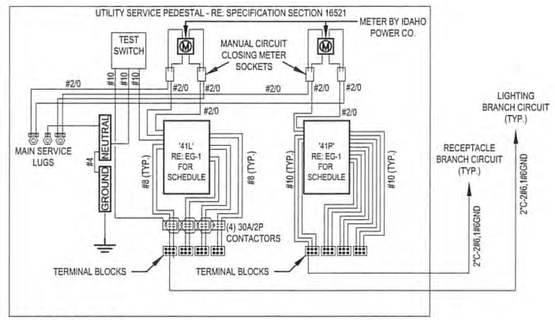


GENERAL NOTES:

A. REFER TO SPECIFICATIONS AND ATTACHMENT A ON SHEETS EG-2 AND EG-3 FOR ADDITIONAL DESCRIPTION AND MANUFACTURER'S PART NUMBER FOR POLE, LUMINAIRE, HOUSING, ETC.

B. WHERE EXISTING POLES ARE UTILIZED, BOLT HOLE PATTERN SHALL MATCH EXISTING.

2 HISTORICAL STREET LIGHT POLE DETAIL
NTS



GENERAL NOTES:

A. IDENTIFICATION LABELS ARE REQUIRED FOR BRANCH BREAKERS. LIGHTING BRANCH BREAKER LABELS TO READ: LIGHTING CIRCUIT NO. (SEE PLANS). POWER BRANCH BREAKER LABELS TO READ: POWER CIRCUIT NO. (SEE PLANS).

B. SERVICE PEDESTAL TO BE NEMA TYPE '3R' FURNISHED WITH PADLOCK HASP.

C. DEAD FRONT CONSTRUCTION IS REQUIRED ON ALL CABINETS.

D. PLUG-IN TYPE BREAKER TO BE USED ON "B" SERVICES. MAIN BREAKERS TO BE BOLT RETAINED.

E. TERMINAL BLOCKS SHALL BE PRESSURE TYPE, AS REQUIRED FOR #8 THROUGH #2 AWG WIRE

F. ALL SERVICES TO BE UL LABELED FOR MAXIMUM 200 AMP BUS RATING AND "APPROVED FOR SERVICE ENTRANCE EQUIPMENT."

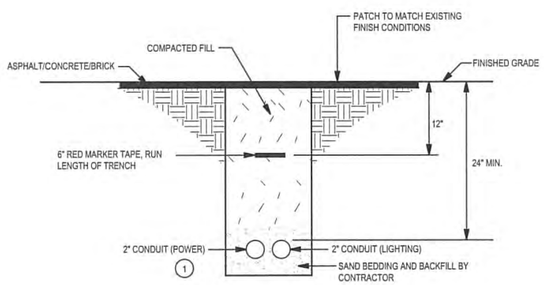
G. THE MAIN BREAKER LABEL TO BE MADE OF RED ON WHITE PLASTIC LAMINATE. THE BRANCH BREAKER LABELS TO BE MADE OF BLACK ON WHITE PLASTIC LAMINATE. THE LEGENDS TO BE ENGRAVED INTO THE STRIP SO AS TO PROVIDE WHITE LEGENDS ON THE REQUIRED BACKGROUND. THE LABELS TO BE PERMANENTLY ATTACHED TO THE DEAD FRONT, NEXT TO THE CORRESPONDING BREAKERS.

H. BRANCH CIRCUIT BREAKERS, BRANCH CIRCUIT WIRE, AND PHOTOELECTRIC CONTROL TO BE SUPPLIED BY THE CONTRACTOR. REFER TO PLANS AND SCHEDULES FOR BRANCH CIRCUIT QUANTITIES.

I. ALL BUSSING TO BE 200 AMP RATED.

J. WIRING TO BE THWN/MTW 600V 90°C RATED

3 METERED UTILITY PEDESTAL DETAIL
NTS



DETAIL NOTES:

1. IF MULTIPLE CONDUITS SHARE TRENCH, PROVIDE SPACING BETWEEN CONDUITS. PROVIDE ZIP TIES, AND TIE ALL CONDUITS TOGETHER TO ENSURE STABILITY.

4 SITE TRENCHING DETAIL
NTS

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CAPITAL CITY DEVELOPMENT CORPORATION

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NJS	NJS
Scale	As Shown

Sheet Title: Electrical Details

Sheet Number: E-5
Of Sheets

ABBREVIATIONS

#	POUNDS OR NUMBER
@	AT
A.B.	ANCHOR BOLTS
A.F.F.	ABOVE FINISH FLOOR
ADD'L.	ADDITIONAL
APPLIC.	APPLICABLE
ARCH'L.	ARCHITECTURAL
B.N.	BOUNDARY NAILING
B.O.D.	BOTTOM OF DECK
BLKG.	BLOCKING
B.M.	BEAM
BOT.	BOTTOM
BRNG.	BEARING
BTWN.	BETWEEN
C	CAMBER
C.F.S.	COLD FORMED STEEL
C.J.P.	COMPLETE JOINT PENETRATION
CL.	CENTERLINE
CLR.	CLEAR
CMU	CONCRETE MASONRY UNIT
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
CONT.	CONTINUOUS
COORD.	COORDINATE
D.B.A.	DEFORMED BAR ANCHOR
DBL.	DOUBLE
DET.	DETAIL
DL	DEAD LOAD
D.P.	DEEP
DWLS.	DOWELS
E.A.	EPOXY ANCHOR
E.B.	EXPANSION BOLT
E.N.	EDGE NAILING
EA.	EACH
ELEV.	ELEVATION
E.A.	EDGE SCREWING
EMBED.	EMBEDMENT
EXIST.	EXISTING
EXT.	EXTERIOR
F.N.	FIELD NAILING
FDN.	FOUNDATION
FIN.	FINISH
FLR.	FLOOR
FRMG.	FRAMING
FTG.	FOOTING
G.S.N.	GENERAL STRUCTURAL NOTES
G.A.	GAUGE
GLB	GLU-LAM BEAM
H.A.S.	HEADED ANCHOR STUD
H.S.B.	HIGH STRENGTH BOLT
HORIZ.	HORIZONTAL
INFO.	INFORMATION
INT.	INTERIOR
J.A.	JOIST BEARING
JST.	JOIST
K	KIPS (1000 POUNDS)
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LSL	LAMINATED STRAND LUMBER
LVL	LAMINATED VENEER LUMBER
M.A.	MACHINE BOLT
MAS.	MASONRY
MAX.	MAXIMUM
MECH'L	MECHANICAL
MFR.	MANUFACTURER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
N.T.S.	NOT TO SCALE
NO.	NUMBER
O.C.	ON CENTER
O.H.	OPPOSITE HAND
O.W..J.	OPEN WEB STEEL JOIST
OPNG.	OPENING
P.D.F	POWDER DRIVEN FASTENER
P.T.	PRESSURE TREATED
PERP.	PERPENDICULAR
PL.	PLATE
PLF	POUNDS PER LINEAR FOOT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSL	PARALLAM
PT.	POINT
REINF.	REINFORCING
REQ'D.	REQUIRED
SCHED.	SCHEDULE
SHT.	SHEET
SHTG.	SHEATHING
SIM.	SIMILAR
SJ.	SLAB JOINT
SPECS.	SPECIFICATIONS
SQ.	SQUARE
STAGG.	STAGGERED
STD.	STANDARD
STIFF.	STIFFENER
STL.	STEEL
T.A.S.	THREADED ANCHOR STUD
T.N.	TOE NAIL
T.O.F.	TOP OF FOOTING
T.O.M.	TOP OF MASONRY
T.O.S.	TOP OF STEEL
TYP.	TYPICAL
U.O.	UNLESS NOTED OTHERWISE
VERT.	VERTICAL
V.I.F.	VERIFY IN FIELD
W.F.	WIDE FLANGE (BEAM)
W.P.	WORK POINT
W/	WITH
W/O	WITHOUT
WD.	WOOD
W.W.R.	WELDED WIRE REINF.

GENERAL STRUCTURAL NOTES (G.S.N.)

GENERAL

THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SITE CONDITIONS BEFORE STARTING WORK. THE STRUCTURAL ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCY. THESE STRUCTURAL DRAWINGS ARE INTENDED TO PRESENT SUFFICIENT DIMENSIONS TO INDICATE MAJOR PLAN SIZES AND TO LOCATE PRIMARY STRUCTURAL COMPONENTS. THE CONTRACTOR SHALL COORDINATE LOCATION OF SECONDARY ELEMENTS, WALLS, OR MEMBERS RELATED TO OTHER DISCIPLINES. USE DETAILS MARKED "TYPICAL" WHEREVER APPLICABLE. CHANGES, OMISSIONS OR SUBSTITUTIONS ARE NOT PERMITTED WITHOUT THE WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER. REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE 2012 INTERNATIONAL BUILDING CODE (IBC). THE DESIGN, ADEQUACY AND SAFETY OF ERECTION BRACING, SHORING, TEMPORARY SUPPORTS, ETC., IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR, AND HAS NOT BEEN CONSIDERED BY THE STRUCTURAL ENGINEER. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE PRIOR TO THE COMPLETION OF FINISH MATERIALS. THE CONTRACTOR SHALL PROVIDE THE NECESSARY BRACING TO PROVIDE STABILITY PRIOR TO THE APPLICATION OF THE ABOVE-MENTIONED COMPONENTS. OBSERVATION VISITS TO THE SITE BY THE STRUCTURAL ENGINEER SHALL NOT INCLUDE INSPECTION OF THE ABOVE ITEMS.

INFORMATIONAL SUBMITTALS

SUBMITTALS ARE TO BE CHECKED AND APPROVED BY THE GENERAL CONTRACTOR PRIOR TO SUBMITTING FOR STRUCTURAL REVIEW. SUBMITTALS SHALL INCLUDE CURRENT PRODUCT ICC/IAMPO REPORTS WHERE APPLICABLE AND INDICATED LOCATIONS OF USAGE FOR THE PRODUCT. ENSURE ADEQUATE COPIES OF SUBMITTALS ARE SUBMITTED FOR THE CONTRACTOR, ARCHITECT, AND STRUCTURAL ENGINEER TO RETAIN ONE COPY EACH FOR THEIR FILES.

INFORMATIONAL SUBMITTALS ARE REQUIRED FOR THE FOLLOWING:
* CONCRETE MIX DESIGN

DESIGN LOADS

SIDEWALK	250 PSF
GROUND SNOW LOAD, P_G	20 PSF
RISK CATEGORY PER IBC	II
BASIC WIND SPEED, V_{ULT}	115 MPH (3 SEC GUST), EXPOSURE B
IMPORTANCE FACTOR (SEISMIC) I_E	1.0
SS	0.311
S1	0.106
SITE CLASS	D
SDS	0.322
SD1	0.168
SEISMIC DESIGN CATEGORY	C

FOUNDATION

THERE SHALL BE 95% COMPACTION (ASTM D1557 MODIFIED PROCTOR DENSITY) OF ALL BACKFILL SOIL UNDER SLABS ON GRADE.

CAST-IN-PLACE CONCRETE

ATTAIN THE FOLLOWING MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS:
* 4000 PSI—EXPOSED CONCRETE SLABS AND FOUNDATION.

MAXIMUM SLUMP: 3" FOR SLABS AND FOUNDATION.
CONSTRUCTION TO BE IN ACCORDANCE WITH ACI 318-11 (R-11), "CHAPTER 3 FOR STANDARDS FOR TESTS & MATERIALS, CHAPTERS 4, 5, 6 & 7 FOR CONSTRUCTION REQUIREMENTS". REFER TO ACI 302.1R-04 FOR SLAB ON GRADE MIX DESIGN. LOCATION OF CONSTRUCTION OR POUR JOINTS MUST BE APPROVED BY THE LANDSCAPE ARCHITECT & STRUCTURAL ENGINEER IF DIFFERENT FROM THAT SHOWN ON PLANS.

REINFORCING STEEL

WELDED WIRE REINFORCING: ASTM A82 AND A185.
DEFORMED BARS: ASTM A615, GRADE 40 FOR #3; GRADE 60 FOR #4 & LARGER.

LAP SPLICES (HORIZONTAL AND VERTICAL STEEL)
* CONCRETE: 40-BAR DIA. OTHER, UNLESS NOTED OTHERWISE FOR #6 & SMALLER.
* WELDED WIRE FABRIC SPLICES: WIRE SPACING + 2".

CONCRETE COVER:
UNLESS OTHERWISE NOTED ON THESE DRAWINGS, UTILIZE THE FOLLOWING CLEAR EMBEDMENT AT REINFORCING BARS VALUES FOR CAST-IN-PLACE, NON-PRE-STRESSED CONCRETE TYPICALLY:

CONCRETE CAST AGAINST SOIL = 3".
FORMED CONCRETE EXPOSED TO EARTH OR WEATHER = 1-1/2" (#5 OR LESS)
SLAB ON GRADE = 1-1/2".

SECURELY TIE ALL REINFORCING IN PLACE WITH DOUBLE ANNEALED 16-GAUGE IRON WIRE OR APPROVED CLIPS.

EPOXY ADHESIVES

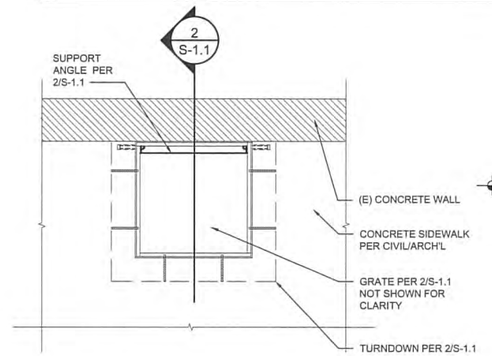
EPOXYADHESIVES:
* FOR INSTALLATION IN REINFORCED MASONRY: SIMPSON "SET-XP" (ER-265)
* FOR INSTALLATION IN UNREINFORCED MASONRY (BRICK): SIMPSON "SET" (ESR-1772)
* FOR INSTALLATION IN CONCRETE: SIMPSON "SET-XP" (ESR-2508)

SPECIAL STRUCTURAL INSPECTIONS

THE OWNER SHALL EMPLOY A SPECIAL INSPECTION SERVICE TO PERFORM INSPECTIONS IN ACCORDANCE WITH CHAPTER 17 OF THE 2012 INTERNATIONAL BUILDING CODE. INSPECTION REPORTS FOR THE ITEMS LISTED IN THE "SPECIAL INSPECTION SCHEDULE" SHALL BE FURNISHED TO THE STRUCTURAL ENGINEER OF RECORD IN A TIMELY MANNER. INSPECTION REPORTS SHALL INDICATE THAT WORK INSPECTED WAS DONE IN CONFORMANCE TO APPROVED CONSTRUCTION DOCUMENTS. DISCREPANCIES THAT ARE NOT CORRECTED SHALL BE BROUGHT TO THE ATTENTION OF THE STRUCTURAL ENGINEER OF RECORD PRIOR TO THE COMPLETION OF THAT PHASE OF THE WORK. A FINAL REPORT DOCUMENTING THE REQUIRED SPECIAL INSPECTIONS AND CORRECTION OF ANY DISCREPANCIES NOTED IN THE INSPECTIONS SHALL BE SUBMITTED TO THE OWNER AND STRUCTURAL ENGINEER OF RECORD.

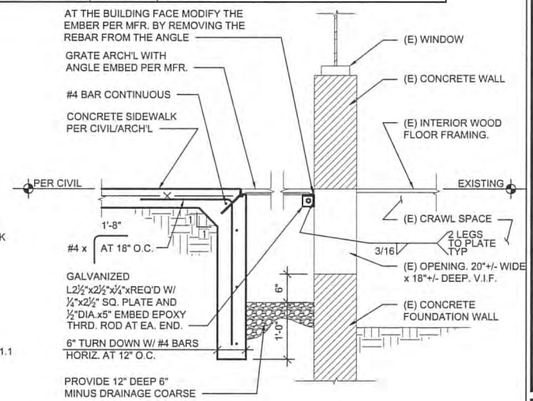
SPECIAL INSPECTION REQUIREMENTS

SYSTEM OR MATERIAL	INSPECTION: IBC CODE REFERENCE	INSPECTION: CODE OR STANDARD REFERENCE	FREQUENCY: CONTINUOUS	FREQUENCY: PERIODIC	REMARKS
CONCRETE					
REINFORCING STEEL	1704.4 1907.5 1913.4 1901.4.2	ACI 318: 3.5 ACI 318: 7.1-7.7		X	TOLERANCES AND REINFORCING PLACEMENT PER ACI 7.5; SPACING LIMITS FOR REINFORCING ACI 7.6
INSPECTION OF ANCHORS INSTALLED IN HARDENED CONCRETE	1912.1	ACI 318: 3.8.6, 8.1.3, 21.1.8		X	FOR POST INSTALLED ANCHORS INTO HARDENED CONCRETE AS NOTED PER PLAN
VERIFYING USE OF REQUIRED MIX DESIGN(S)	TABLE 1704.4 1904 1905.2-4 1913.2 1913.3 1901.4.1	ACI 318 CHAPTER 4 ACI 318: 5.2-5.4		X	
CONCRETE PLACEMENT	TABLE 1704.4 1905.9-10	ACI 318 1.3.2.D ACI 318 5.9-5.10	X		
CONCRETE CURING	TABLE 1704.4 1905.11-13 1913.9	ACI 318: 1.3.2.D ACI 318: 5.11-5.13		X	
VERIFICATION OF FORMWORK	TABLE 1704.4 1906.1	ACI 318: 6.1.1		X	SPECIAL INSPECTIONS APPLY TO SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED
CONCRETE -TESTING					
AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS AND DETERMINE THE TEMPERATURE OF THE CONCRETE	TABLE 1704.4	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	X		"FABRICATE SPECIMENS AT TIME FRESH CONCRETE IS PLACED ONCE EACH DAY FOR A GIVEN CLASS OF CONCRETE, OR LESS THAN ONCE FOR EACH 150 YDS OF CONCRETE, OR LESS THAN ONCE FOR EACH 5,000 FT2 OF SURFACE AREA FOR SLABS/WALLS. ONCE EACH SHIFT FROM IN-PLACE WORK OR FROM TEST PANEL AND MINIMUM ONE SPECIMEN FOR EACH 50 CUBIC YARDS. ""PRE-CONSTRUCTION TESTS AS REQUIRED PER THE BUILDING OFFICIAL","
CONCRETE STRENGTH	TABLE 1704.4 1903 1905	ASTM C 39	X		
CONCRETE SLUMP		ASTM C 143	X		
CONCRETE AIR CONTENT		ASTM C 231	X		
CONCRETE TEMPERATURE		ASTM C 1064	X		
POST INSTALLED CONCRETE ANCHORS					
INSPECTION OF ANCHORS INSTALLED IN HARDENED CONCRETE	1912.1	ICC EVALUATION REPORT ACI 318: 3.8.6, 8.1.3, 21.1.8		X	SPECIAL INSPECTIONS APPLY TO ANCHOR PRODUCT NAME, TYPE, AND DIMENSIONS, HOLE DIMENSIONS, COMPLIANCE WITH DRILL BIT REQUIREMENTS, CLEANLINESS OF THE HOLE AND ANCHOR, ADHESIVE EXPIRATION DATE, ANCHOR/ADHESIVE INSTALLATION, ANCHOR EMBEDMENT, AND TIGHTENING TORQUE



1 REPLACEMENT GRATE - PLAN

SCALE: NONE



2 REPLACEMENT GRATE - SECTION

SCALE: NONE

NOTE: SEE CIVIL FOR APPLICATION OF THESE DETAILS. OCCURS IN (3) LOCATIONS.

Issue Description	Date
PERMIT	4/6/15

PROFESSIONAL ENGINEER LICENSED 14767 04/21/2015 STATE OF IDAHO CRAIG E. BRASHER

Ally Structural Consulting, LLC
www.allystructural.com
208-949-5993

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Landscape Architecture
495 Main Street
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2015 WESTSIDE DISTRICT STREETSCAPES

BOISE, IDAHO

CAPITAL CITY DEVELOPMENT CORPORATION

Job Number: 1509

Drawn	Checked
CB	CB
Scale	As Shown

Sheet Title: STRUCTURAL

Sheet Number: S-1.1

Of Sheets

Appendix E: Site Selection Assessment

Silva Cell Monitoring Site Selection Assessment

- **Objectives**
  - **Fulfill permit requirements**
    - **Permit Summary:** Evaluate effectiveness of appropriate use, design, types, size, operation and maintenance of LID techinique by monitoring, calculating or modeling changes in runoff to develop recommendations for future adoption of such LID techniques.
  - **PMEP:**
    - Level of Service Goals and Outcome Levels
    - Section 4.4: Controlling pollutants of concern by using flow reduction as a surrogate for pollutant load reduction
    - Data comparable across programs
- **Monitoring Approach:**
    - Consistent with Permeable Paver Pilot Project Monitoring = comparable data
    - Measure precipitation
    - Measure depth of water in observation wells
    - Measure infiltration rate of underlying soils
    - Calculate runoff entering systems
    - Model runoff infiltrating system
    - Record bypass on DI cameras
    - Record on-site observations (ie. maintenance requirements)
- **Site Options:**
  - **6th St. between Main St. and Idaho St.** (Old Boise)
    - **Pros**
      - Already installed
    - **Cons**
      - No infiltration test performed
      - Less convenient access for monitoring
      - Not in monitored sub-watershed
      - Closest rain gauges – East located 1 mile away – foothills precip not typical of downtown & Front located 0.7 miles away
  - **North side of Main St. between 14th St. and 15th St.** (Big O Tire)
    - **Pros**
      - Infiltration Test being performed=more accurate modeling
      - Located within Americana sub-watershed
      - Convenient monitoring access-close to other pilot project
      - Closest Rain gauge –Front only 0.15 miles away
    - **Cons**
      - Not sized based on runoff volumes =less accurate measure of volume retained (expect bypass w/ any event > 0.15")
      - Combo of two systems- one small and one medium-more complicated modeling
      - Will require two cameras-one for each DI

- Not yet installed – construction estimated to start Summer 2015

- **Other Factors**
  - Drainage area contains some pervious surface

- **South Side of Main St. between 14th St. and 15th St.** (Petso Bldg)
  - **Pros**
    - Infiltration Test being performed
    - Located within Americana sub-watershed
    - Convenient monitoring access-close to other pilot project
    - Closest Rain gauge –Front only 0.15 miles away
    - Only 1 DI = only 1 camera
    - Sized to handle appropriate runoff volumes – wouldn't expect bypass unless storm >1"
    - Most straightforward drainage area and simplest system = most accurate modeling
  - **Cons**
    - Not yet installed – construction estimated to start Summer 2015
- **East side of 15th St. between Grove St. and alley (Alloway Lighting)**
  - **Pros**
    - Infiltration Test being performed
    - Located within Americana sub-watershed
    - Convenient monitoring access-close to other pilot project
    - Closest Rain gauge –Front only 0.1 miles away
  - **Cons**
    - Not yet installed – construction estimated to start Summer 2015
    - Combo of two systems- one small and one medium-more complicated modeling
    - Will require two cameras-one for each DI
    - Least clearly delineated drainage area = less accurate runoff calculations
    - Not sized based on runoff volumes = less accurate measure of volume retained (bypass expected w/ any event > 0.05")

Location			**Drainage Area (sf)**	**Silva Cell Storage (cf)**	**Storm Size**			
					1”	**0.5”**	**0.25”**	**0.1”**
Petso	Runoff		5135	428	420	210	105	30
	Bypass				**0**	**0**	**0**	**0**
Alloway	Runoff	System 1	19,450	172	1590	800	400	160
	Bypass to System2				1420	630	230	0
	Runoff	System 2	16,000	72	1305	650	330	130
	Combined Input of System 1 + Runoff				2725	1280	560	130
	Bypass of Total System		35,450	244	**2650**	**1205**	**490**	**60**
Big O	Runoff	System 1	17,267	88	1410	705	350	100
	Bypass to System 2				1320	620	260	10
	Runoff	System 2	5800	208	470	240	120	30
	Combined Input				1790	860	380	40
	Bypass of Total System		23,067	296	**1580**	**650**	**170**	**0**
Old Boise	Runoff		5300	372	430	215	110	20
	Bypass				**60**	**0**	**0**	**0**

Appendix F: Modeling Technical Memo

950 West Bannock Street
Boise, ID 83702

T: 208.389.7700
F: 208.389.7750

November 13, 2015

Monica Lowe
Ada County Highway District
318 East 37th Street
Garden City, ID 83714

148478

Subject: Task 6.1 Silva Cell Project File for HydroCAD

Dear Ms. Lowe,

This letter includes the results of the Silva Cell Modeling Component of the Silva Cell Monitoring Plan Project. This task included reviewing existing site data, preparing model inputs, and developing a HydroCAD project file for the monitored Silva Cell installation. The purpose of this task was to provide Ada County Highway District (ACHD) with a HydroCAD project file that can be used to meet the objectives of the Silva Cell Monitoring Plan. The project file will allow ACHD to directly estimate changes in runoff quantities and flow rates pre- and post-construction, compare hydrological conditions between scenarios, and develop site hydrographs. The model file can later be used to assess performance and maintenance effectiveness. In addition, the model can be validated using physical and observational data.

This letter summarizes the methodology and assumptions used in the development of the HydroCAD project file. Attached with this letter is the project file and supporting data.

Introduction

Green Stormwater Infrastructure (GSI) effectiveness is required as part of the Phase I Permit. Part B.2.C indicates that "each pilot project must include an evaluation of the effectiveness of Low Impact Development technique(s) or practice(s) used for on-site control of water quality and/or quantity." As a result, ACHD selected Silva Cell installation as a potential pilot study opportunity. In order to begin to evaluate the effectiveness of the GSI technique, ACHD, through the recommendation of the Silva Cell manufacturer, will use HydroCAD to model the effectiveness of this type of GSI solution. This letter includes the methodology toward developing the inputs for the model, model inputs, and assumptions for both preconstruction and post construction conditions.

Methodology

Model Set-Up

The HydroCAD project file was developed to assess the pre- and post-construction conditions at the monitoring site location. The model includes two drainage areas, one for each Silva Cell basin with a distinct catch basin inlet (Figure 1).



Figure 1. Drainage areas for the west and east Silva Cell basins, located on Main St. between 14th and 16th Ave. in downtown Boise, Idaho.

A summary of the site description and key parameters used in the model is provided below. All site information was derived from materials provided by ACHD. Information is based on design drawings, pre-installation geotechnical investigations, and as-built conditions. Furthermore, the infiltration rate was provided by STRATA from a geotechnical investigation of the subgrade conducted on October 7, 2015. A conservative design safety factor of 2 was applied, resulting in a design infiltration rate of 2 in/hr.

Location: east half of block on the south side of Main St. between 14th Street and 15th Street, Boise, Idaho
Land cover: asphalt road surface and concrete
Total drainage area: 7,634 sq. ft.
East Basin: 4,855 sq. ft.
West Basin: 2,779 sq. ft.

Silva Cell Capacity (Type 1 Cells)
East Basin:
Soil: 100 cells x 11.3 cubic feet/cell = 1,060 cu.ft.
Runoff: 100 cells x 2.1 cu. ft. runoff/cell + 10 cu.ft. perf. pipe = 217 cu. ft
West Basin:
Soil: 102 cells x 11.3 cubic feet/cell = 1,081 cu.ft
Runoff: 102 cells x 2.1 cu. ft. runoff/cell + 25 cu.ft. perf. pipe = 239 cu.ft.
Area description: 98% impervious
Slope: 0.01
Underlying soils: Sandy silt/silty sand (subgrade)
Percolation rate of underlying soil: 4 inches per hour (measured)
Safety Factor: 2.0
Design Infiltration rate: 2.0 inches per hour

The time-of-concentration (Tc) is a required input used to describe the lag time of the basin. The Tc line was measured from the farthest point in the subbasin to the drop inlet. The slope of the Tc line was determined from survey data. A weighted curve number of 98 was estimated based on the area, land use, and soil type of the subcatchments. The curve number indicates that approximately 98 percent of rainfall onto the site will become runoff. Table 1 below includes a summary of the model inputs for the two basins.

Table 1. HydroCAD Runoff Model Inputs

Basin ID	Number of Silva Cells	Drainage Area (ac)	Time of Concentration (min)	Slope of Subbasin (ft/ft)	Weighted CN
East Basin	100	4,855	3.1	0.009	98
West Basin	102	2,779	3.1	0.006	98

Storage Definition

The Silva Cell storage was entered using a pre-defined module within HydroCAD for the manufactured Silva Cell Type I installation. The module accounts for 20 percent storage in the bioretention soil, as well as 1 in spacing between cells. Two alternative modeling approaches were included in the project file. Alternative 1 was to model the Silva Cell basins as two separate storage units connected by an outlet structure from the East basin to the West basin. The storage was entered as a stack of two cells, set in two rows of 25 and 26 cells for the East and West basins, respectively. Storage within the 6-inch perforated pipe was included as well, with 75 feet of pipe in the West basin and 45 feet within the East basin. This approach allows for the estimation of the individual storage and peak discharge reduction from each set of Silva Cells.

The second approach was to model all the cells as one continuous storage unit, with two stacks of 101 cells, set in two rows. There is no physical barrier between the East and West Silva Cells; therefore, the second approach is more representative because it captures the peak elevation in the entire system.

Outlet Configuration and Routing

For Configuration 1, the Silva Cell system was modeled as two separate storage "ponds" connected by a 6-inch perforated pipe that runs the length of both basins. Both basins were modeled with an exfiltration layer at the bottom invert with a constant velocity of 2 in/hr, simulating the flow of stormwater downward through the cell and into the native soil. Once the infiltration rate is exceeded, the cell will fill up until the ponding elevation reaches the invert of the perforated pipe, through which water will flow back to the drop inlet. Overflow from the cell will flow down Main Street to a catch basin connected to the storm sewer.

For Configuration 2, the discharge multiplier for the perforated pipe and drop inlet controls was changed to "2," to represent the East and West overflow outlet devices.

Meteorological Data

Local rainfall data was entered into the project file in the form of an intensity-duration-frequency curve. HydroCAD then generated synthetic rainfall distributions for use with the Soil Conservation Service's (SCS) TR-20 runoff calculation procedure. The SCS procedure is a common runoff calculation methodology which relies on an area-weighted curve number, based on a subcatchment's land cover and soil characteristics.

Local precipitation frequency data used for the analysis came from the NOAA Atlas 2. A summary of the rainfall intensities and storm depths for each design storm event is included in Table 2 below.

Table-1. Rainfall Intensity and Depths from NOAA Atlas 2 for 24-hour Design Storm Events

Design Return-Period (Years)	Rainfall per hour (in)	Storm Depth (in)
2	0.05	1.20
5	0.07	1.60
10	0.08	2.00
25	0.09	2.20
30	0.10	2.28
50	0.11	2.60
100	0.12	2.80

1. NOAA Atlas 2 Depth-Duration-Frequency and Intensity-Duration-Frequency Curves

Assumptions

Several assumptions were required to model the Silva Cell system including the following:

- For Configuration 1, it was assumed that flow entering the perforated pipe from the East basin will be routed through the West basin outlet structure.

- A small overflow ponding storage was defined at the street level in order to provide valid results for storm events > 50-year.
- Storage within the drop inlet was considered insignificant and therefore omitted.
- For the exfiltration outlet, a minimum phase-in depth of 0.01 ft was entered in order to reduce instability and oscillations in the runoff calculation. The default value is zero. The phase-in depth is often applied when modeling exfiltration velocity for a flat-bottomed pond, allowing the exfiltration to be phased-in over the specified depth.

Other Considerations

DeepRoot, manufacturers of the Silva Cell, indicate that a delay in the inflow may be observed due to the limiting inflow of the bioretention soil in comparison to an open-cavity pond. This potential delay was not accounted for in this model set-up. If observations indicate that a delay in the inflow occurs, there may be a need to add an additional model element. Modeling elements would likely include addition of a temporary storage basin above the Silva Cell unit with a decreased exfiltration rate, to simulate temporary storage of the runoff and delayed inflow into the bioretention layer.

Conclusion

The project file was developed based on the best data available, including the design drawing profile of the constructed system. We do not expect that any significant changes will be required to the model inputs upon further validation. We have included attachments for the project input file and supporting data.

Brown and Caldwell appreciates that ACHD has requested our services in assisting with this project and look forward to engaging with you in completion of the rest of this project. Should you have any questions, please do not hesitate to call me at 208 389-7730.

Very truly yours,

Brown and Caldwell



Andy Weigel, Project Manager

AW:mm

Attachments (1)

- Attachment A: HydroCAD project file

Limitations:

This document was prepared solely for ACHD in accordance with professional standards at the time the services were performed and in accordance with the contract between ACHD and Brown and Caldwell dated October 1, 2015. This document is governed by the specific scope of work authorized by ACHD; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by ACHD and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Appendix G: Observation Form

Silva Cell Project Observation Form - East & West Basin

Date:		Time:		Personnel:			
Weather:					Last Rain:		
Phase:	Pre-Construction		Construction		Post-Construction		

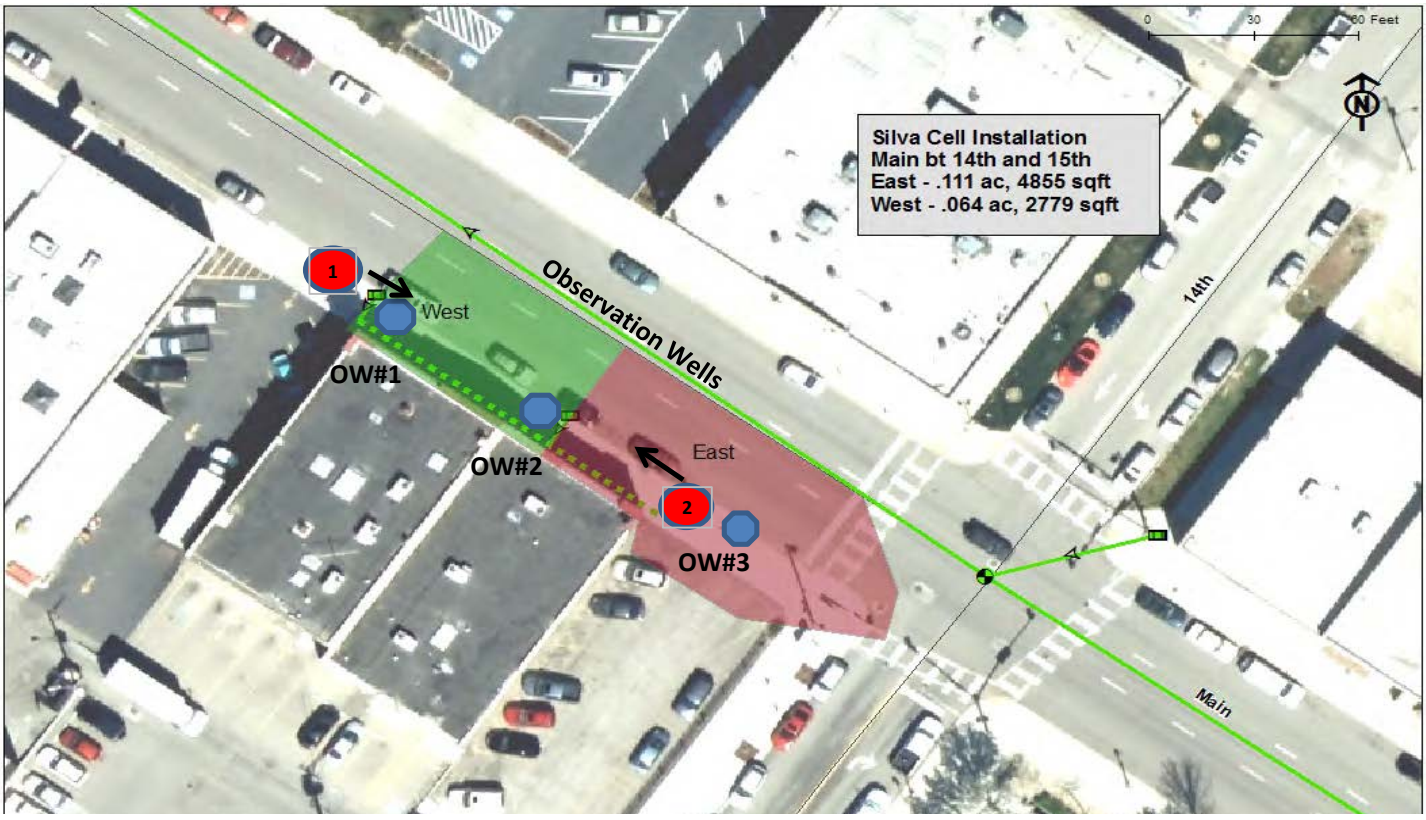
Instructions:

1. Take photos at each station (1-2) and record file or time of each photo.
2. Note the presence of contaminants (oil sheen, sediments, etc), gutter flow (before and after drop inlet)
3. Note flow coming off roof drains (HF= heavy flow, MF=medium flow, LF= low flow, NF = no flow)
4. In constrution phase note sub-surface conditions, tracking, run-on, utility conflicts and any other concerns
5. In post-construction phase note any evidence of drop inlet overflow, snow event performance & well levels.
6. Record any maintenance required (leaf debris clogging drop inlets, etc.)

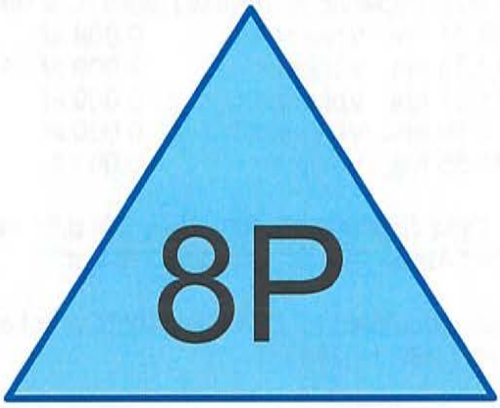
Observation types: PW = ponding water, RU = run-off, CS = contaminants ,O= oil sheen, SS= sediments

Observation Type	Observation Notes

Observation Well #1 Level:		Observation Well #2 Level:		Observation Well #3 Level:	



Appendix H: Model Results



East Basin- 100 Silva Cells

Subcat Reach Pond Link

Routing Diagram for Boise_SilvaCell_Config1

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net, Printed 12/22/2015
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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 0.99" for 2-Year event
Inflow = 0.12 cfs @ 12.01 hrs, Volume= 0.009 af
Outflow = 0.03 cfs @ 12.35 hrs, Volume= 0.009 af, Atten= 70%, Lag= 20.4 min
Discarded = 0.01 cfs @ 11.57 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.02 cfs @ 12.35 hrs, Volume= 0.001 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.06' @ 12.35 hrs Surf.Area= 272 sf Storage= 104 cf

Plug-Flow detention time= 46.1 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 46.1 min (832.1 - 786.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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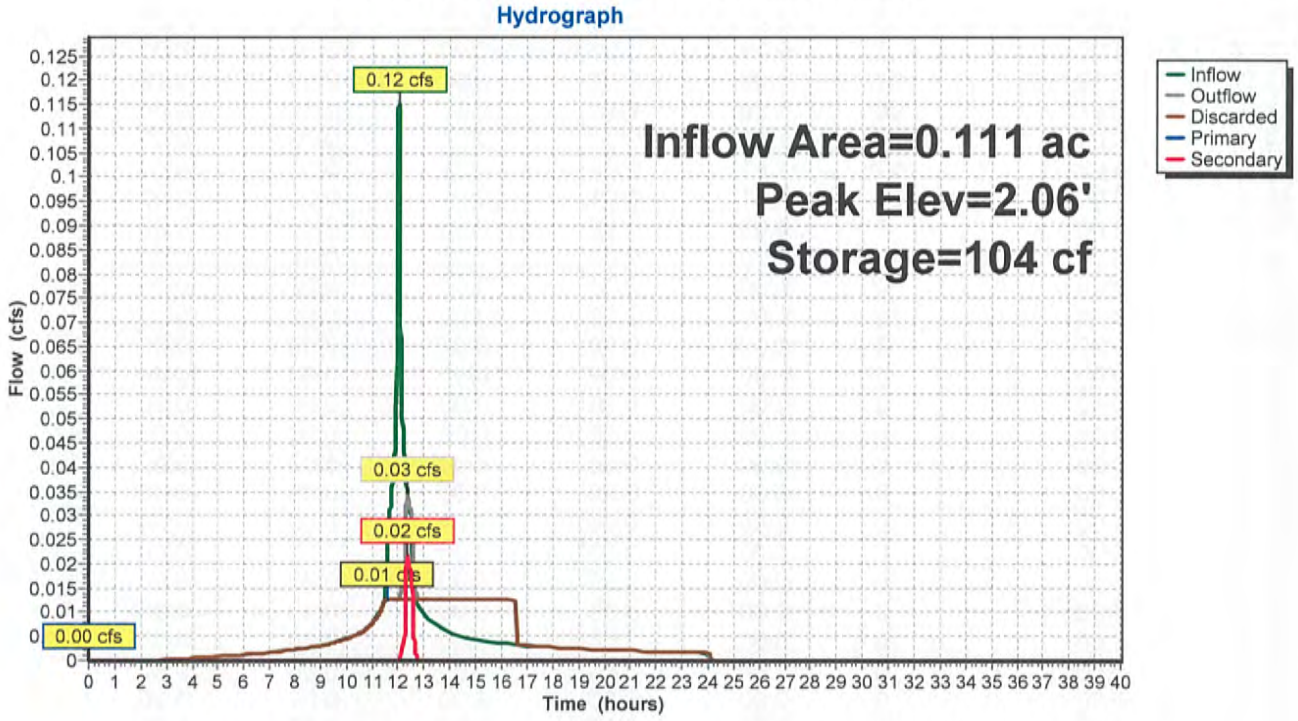
Discarded OutFlow Max=0.01 cfs @ 11.57 hrs HW=0.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.02 cfs @ 12.35 hrs HW=2.06' TW=1.00' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.02 cfs @ 0.81 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.11**	**54**	**1.08**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.01**	**98**	**1.96**	**0.01**	0.01	0.00	**0.00**
14.00	0.01	79	1.58	0.01	0.01	0.00	0.00
15.00	0.00	52	1.03	0.01	0.01	0.00	0.00
16.00	0.00	21	0.41	0.01	0.01	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 1.38" for 5-Year event
Inflow = 0.16 cfs @ 12.01 hrs, Volume= 0.013 af
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 0.013 af, Atten= 46%, Lag= 6.2 min
Discarded = 0.01 cfs @ 11.37 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.07 cfs @ 12.11 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.15' @ 12.11 hrs Surf.Area= 272 sf Storage= 109 cf

Plug-Flow detention time= 42.0 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 41.9 min (818.1 - 776.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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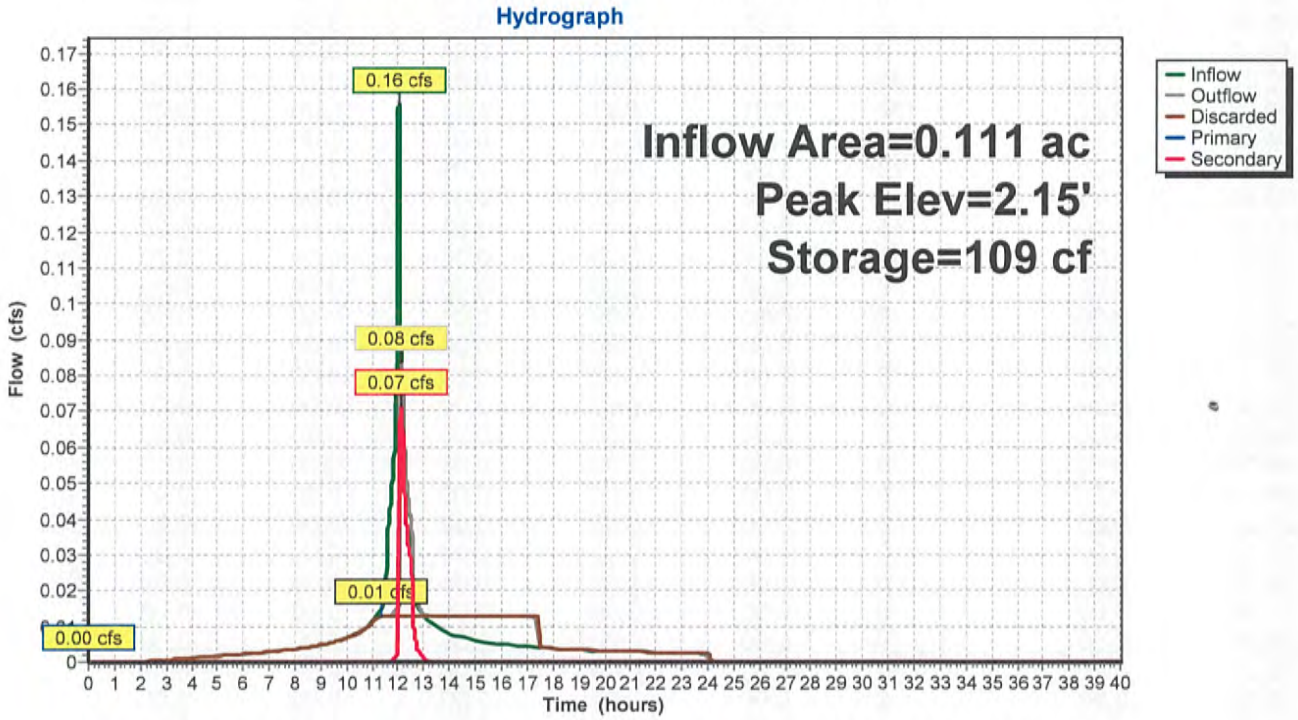
Discarded OutFlow Max=0.01 cfs @ 11.37 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.07 cfs @ 12.11 hrs HW=2.15' TW=1.45' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.07 cfs @ 1.46 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.01	0	0.01	0.01	0.01	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.15**	**85**	**1.70**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.01**	**100**	**2.01**	**0.01**	0.01	0.00	**0.00**
14.00	0.01	90	1.81	0.01	0.01	0.00	0.00
15.00	0.01	70	1.39	0.01	0.01	0.00	0.00
16.00	0.00	44	0.88	0.01	0.01	0.00	0.00
17.00	0.00	15	0.30	0.01	0.01	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 1.77" for 10-Year event
Inflow = 0.20 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.15 cfs @ 12.05 hrs, Volume= 0.016 af, Atten= 28%, Lag= 2.4 min
Discarded = 0.01 cfs @ 11.06 hrs, Volume= 0.012 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.13 cfs @ 12.05 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.39' @ 12.05 hrs Surf.Area= 272 sf Storage= 125 cf

Plug-Flow detention time= 39.4 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 39.4 min (807.8 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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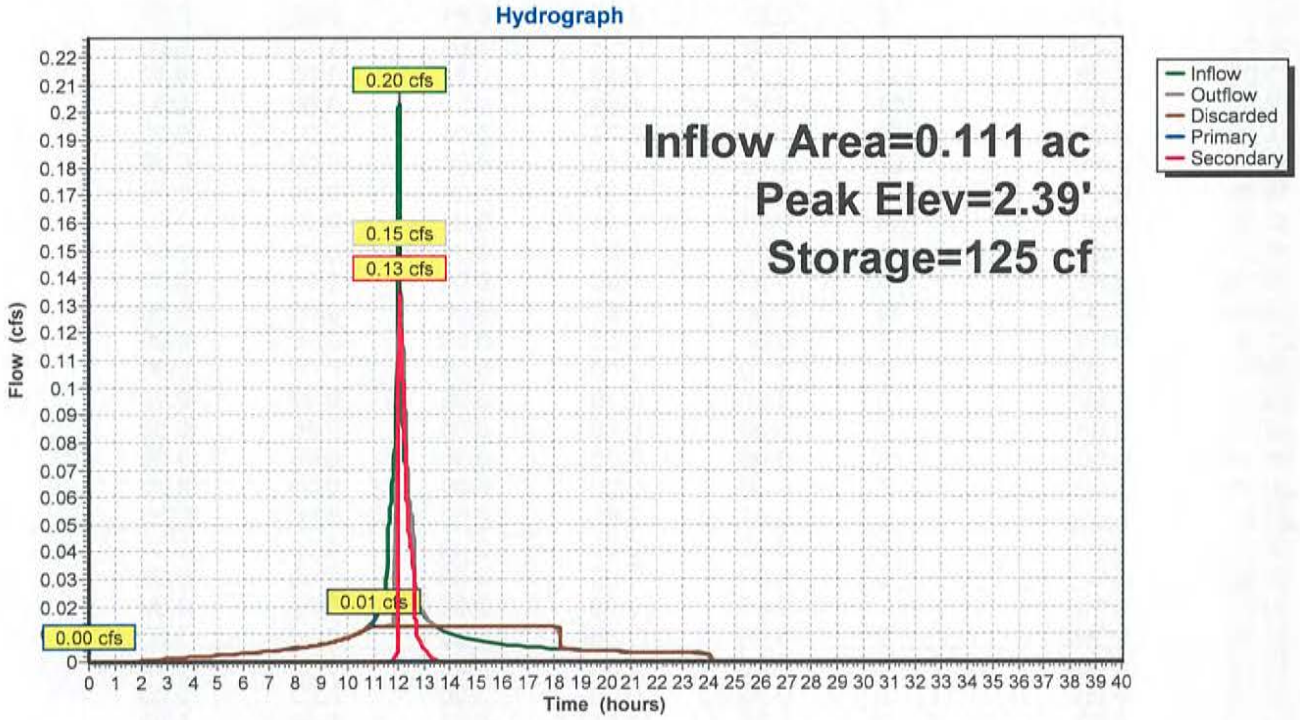
Discarded OutFlow Max=0.01 cfs @ 11.06 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.13 cfs @ 12.05 hrs HW=2.39' TW=1.96' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.13 cfs @ 2.75 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.01	0	0.00	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	0.01	0.00	0.00
11.00	0.01	1	0.02	0.01	**0.01**	0.00	0.00
12.00	**0.20**	**116**	**2.26**	**0.12**	**0.01**	0.00	**0.10**
13.00	**0.02**	**101**	**2.02**	**0.02**	0.01	0.00	**0.00**
14.00	0.01	97	1.94	0.01	0.01	0.00	0.00
15.00	0.01	82	1.64	0.01	0.01	0.00	0.00
16.00	0.01	61	1.21	0.01	0.01	0.00	0.00
17.00	0.01	36	0.71	0.01	0.01	0.00	0.00
18.00	0.00	8	0.15	0.01	0.01	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 1.97" for 25-Year event
Inflow = 0.24 cfs @ 12.01 hrs, Volume= 0.018 af
Outflow = 0.22 cfs @ 12.04 hrs, Volume= 0.018 af, Atten= 7%, Lag= 1.9 min
Discarded = 0.01 cfs @ 10.94 hrs, Volume= 0.013 af
Primary = 0.00 cfs @ 12.04 hrs, Volume= 0.000 af
Secondary = 0.21 cfs @ 12.04 hrs, Volume= 0.006 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 3.01' @ 12.04 hrs Surf.Area= 500 sf Storage= 138 cf

Plug-Flow detention time= 37.8 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 37.8 min (802.2 - 764.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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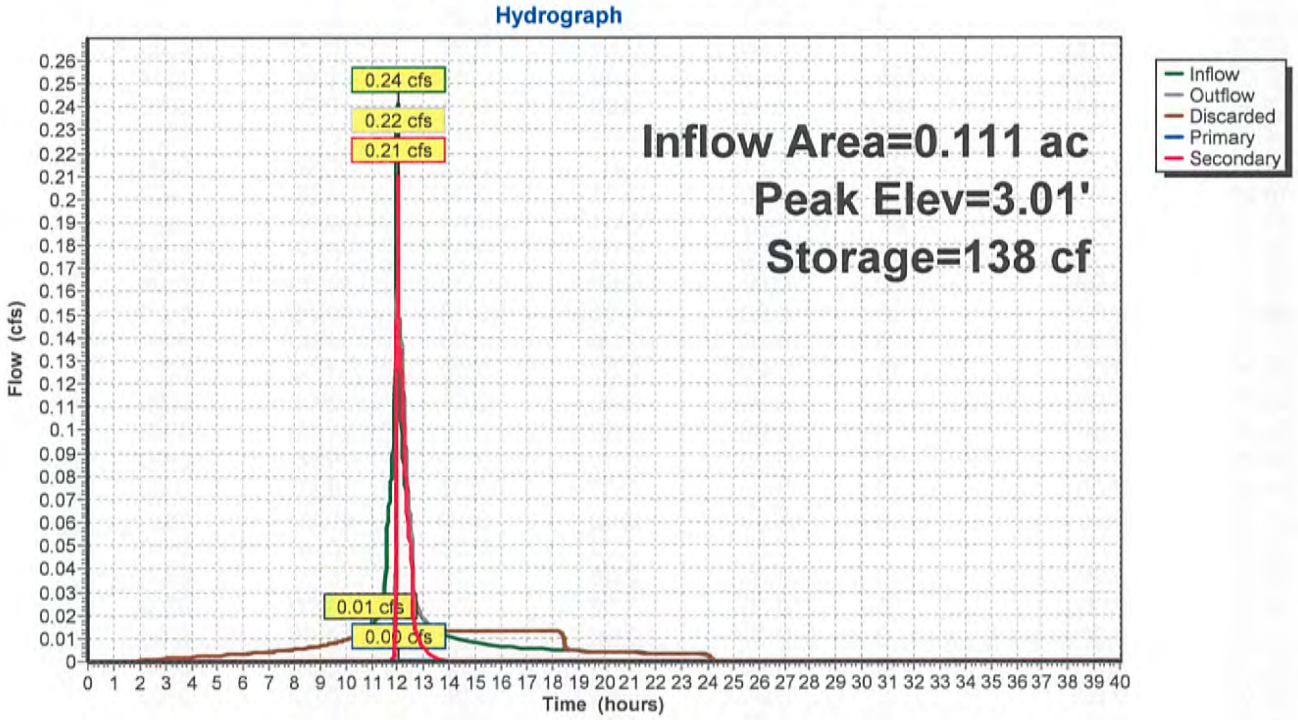
Discarded OutFlow Max=0.01 cfs @ 10.94 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 12.04 hrs HW=3.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Weir Controls 0.00 cfs @ 0.01 fps)
└**3=Perforated Pipe Outlet to Drop Inlet** (Passes 0.00 cfs of 0.00 cfs potential flow)

Secondary OutFlow Max=0.20 cfs @ 12.04 hrs HW=2.95' TW=2.20' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.20 cfs @ 4.17 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.01	0	0.00	0.01	0.01	0.00	0.00
9.00	0.01	0	0.01	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
11.00	0.02	2	0.04	0.01	**0.01**	0.00	0.00
12.00	**0.24**	**128**	**2.44**	**0.16**	0.01	**0.00**	**0.14**
13.00	**0.02**	**101**	**2.03**	**0.02**	0.01	**0.00**	**0.01**
14.00	0.01	98	1.96	0.01	0.01	0.00	0.00
15.00	0.01	85	1.71	0.01	0.01	0.00	0.00
16.00	0.01	65	1.30	0.01	0.01	0.00	0.00
17.00	0.01	41	0.82	0.01	0.01	0.00	0.00
18.00	0.00	14	0.28	0.01	0.01	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 2.05" for 30-Year event
Inflow = 0.23 cfs @ 12.01 hrs, Volume= 0.019 af
Outflow = 0.18 cfs @ 12.05 hrs, Volume= 0.019 af, Atten= 22%, Lag= 2.5 min
Discarded = 0.01 cfs @ 10.80 hrs, Volume= 0.014 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.17 cfs @ 12.05 hrs, Volume= 0.005 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.71' @ 12.05 hrs Surf.Area= 0 sf Storage= 135 cf

Plug-Flow detention time= 38.9 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 38.8 min (803.6 - 764.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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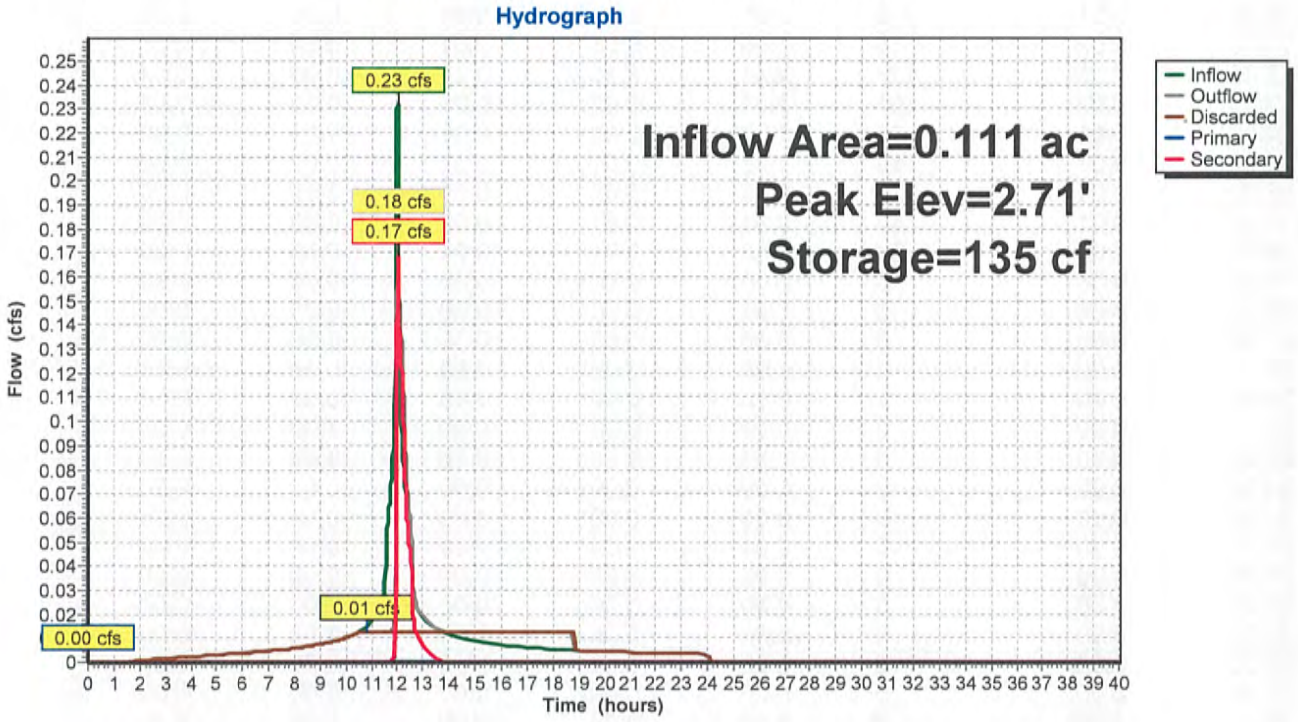
Discarded OutFlow Max=0.01 cfs @ 10.80 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.17 cfs @ 12.05 hrs HW=2.70' TW=2.19' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.17 cfs @ 3.44 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.01	0	0.00	0.01	0.01	0.00	0.00
9.00	0.01	0	0.01	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
11.00	0.02	4	0.08	0.01	**0.01**	0.00	0.00
12.00	**0.23**	**127**	**2.41**	**0.15**	0.01	0.00	**0.14**
13.00	**0.02**	**101**	**2.03**	**0.02**	0.01	0.00	**0.01**
14.00	0.01	99	1.99	0.01	0.01	0.00	0.00
15.00	0.01	89	1.78	0.01	0.01	0.00	0.00
16.00	0.01	72	1.43	0.01	0.01	0.00	0.00
17.00	0.01	49	0.99	0.01	0.01	0.00	0.00
18.00	0.01	24	0.49	0.01	0.01	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 2.37" for 50-Year event
Inflow = 0.27 cfs @ 12.01 hrs, Volume= 0.022 af
Outflow = 0.22 cfs @ 12.03 hrs, Volume= 0.022 af, Atten= 17%, Lag= 1.5 min
Discarded = 0.01 cfs @ 10.52 hrs, Volume= 0.015 af
Primary = 0.02 cfs @ 12.04 hrs, Volume= 0.000 af
Secondary = 0.21 cfs @ 12.00 hrs, Volume= 0.007 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 3.01' @ 12.04 hrs Surf.Area= 500 sf Storage= 141 cf

Plug-Flow detention time= 37.9 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 37.9 min (798.8 - 760.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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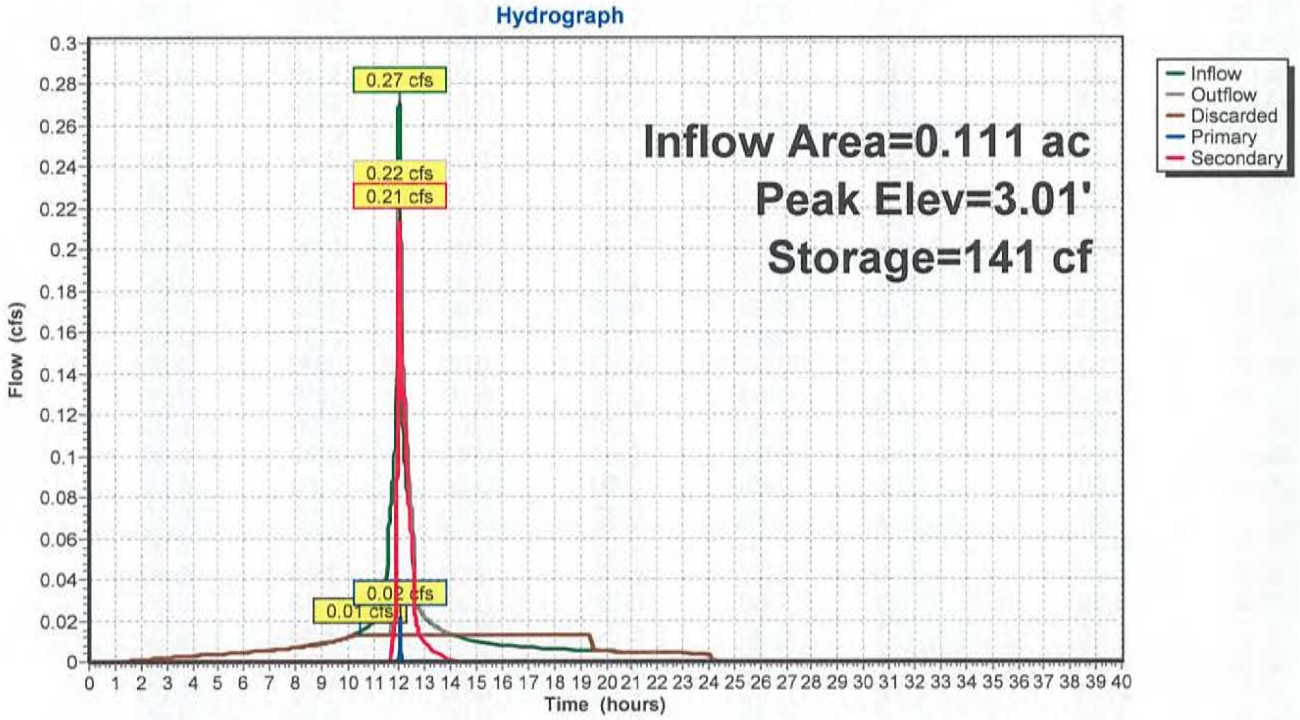
Discarded OutFlow Max=0.01 cfs @ 10.52 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.02 cfs @ 12.04 hrs HW=3.01' (Free Discharge)
└**2=Drop Inlet Overflow** (Weir Controls 0.02 cfs @ 0.33 fps)
└**3=Perforated Pipe Outlet to Drop Inlet** (Passes 0.02 cfs of 0.10 cfs potential flow)

Secondary OutFlow Max=0.21 cfs @ 12.00 hrs HW=3.00' TW=2.23' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.21 cfs @ 4.23 fps)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.01	0	0.00	0.01	0.01	0.00	0.00
8.00	0.01	0	0.01	0.01	0.01	0.00	0.00
9.00	0.01	0	0.01	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
11.00	0.02	9	0.17	0.01	**0.01**	0.00	0.00
12.00	**0.27**	**136**	**3.00**	**0.22**	0.01	**0.00**	**0.21**
13.00	**0.02**	**102**	**2.04**	**0.02**	0.01	**0.00**	0.01
14.00	0.01	100	2.01	0.01	0.01	0.00	0.00
15.00	0.01	94	1.89	0.01	0.01	0.00	0.00
16.00	0.01	80	1.61	0.01	0.01	0.00	0.00
17.00	0.01	61	1.22	0.01	0.01	0.00	0.00
18.00	0.01	39	0.77	0.01	0.01	0.00	0.00
19.00	0.01	14	0.27	0.01	0.01	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 2.57" for 100-Year event
Inflow = 0.30 cfs @ 12.01 hrs, Volume= 0.024 af
Outflow = 0.26 cfs @ 12.03 hrs, Volume= 0.024 af, Atten= 14%, Lag= 1.6 min
Discarded = 0.01 cfs @ 10.38 hrs, Volume= 0.015 af
Primary = 0.07 cfs @ 12.04 hrs, Volume= 0.000 af
Secondary = 0.21 cfs @ 11.98 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 3.02' @ 12.04 hrs Surf.Area= 500 sf Storage= 147 cf

Plug-Flow detention time= 36.8 min calculated for 0.024 af (100% of inflow)
Center-of-Mass det. time= 36.8 min (795.2 - 758.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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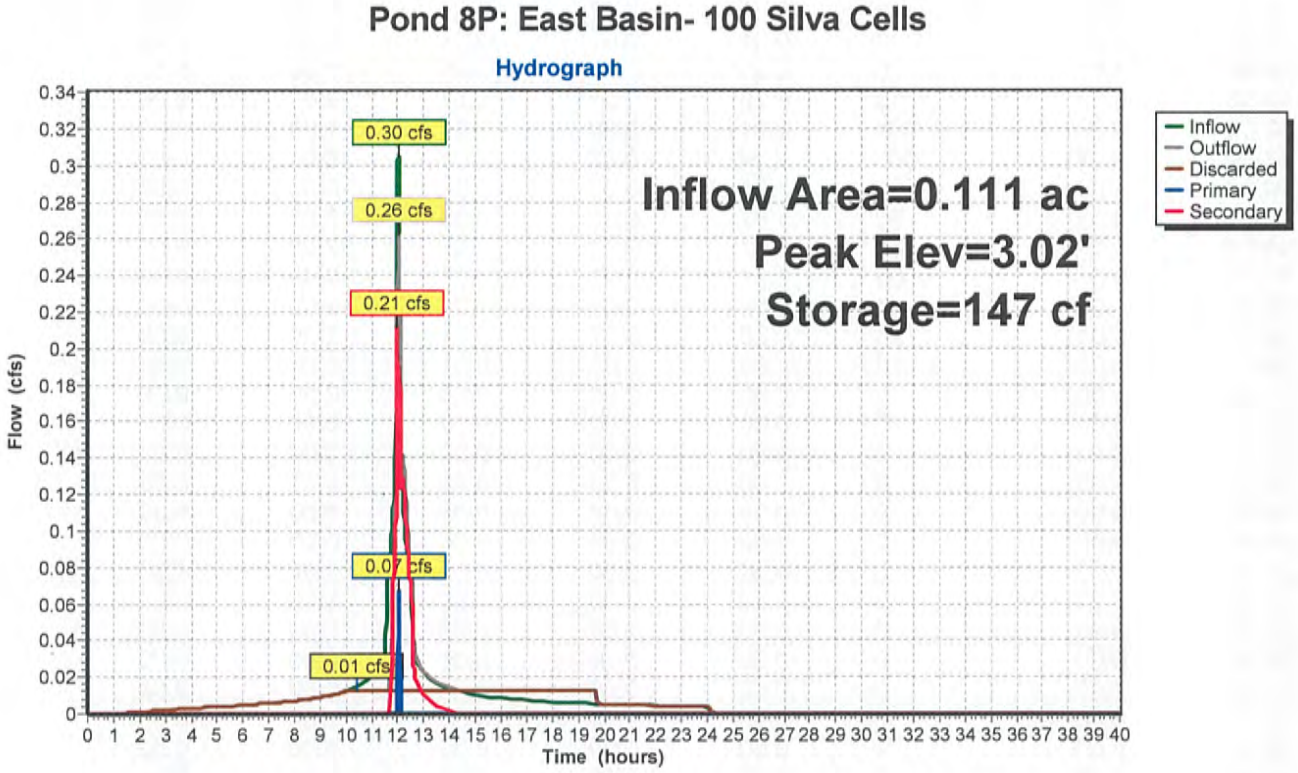
Discarded OutFlow Max=0.01 cfs @ 10.38 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.07 cfs @ 12.04 hrs HW=3.02' (Free Discharge)
└**2=Drop Inlet Overflow** (Weir Controls 0.07 cfs @ 0.49 fps)
└**3=Perforated Pipe Outlet to Drop Inlet** (Passes 0.07 cfs of 0.14 cfs potential flow)

Secondary OutFlow Max=0.20 cfs @ 11.98 hrs HW=3.00' TW=2.26' (Dynamic Tailwater)
└**4=Perforated Pipe** (Orifice Controls 0.20 cfs @ 4.16 fps)



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.01	0	0.00	0.01	0.01	0.00	0.00
8.00	0.01	0	0.01	0.01	0.01	0.00	0.00
9.00	0.01	0	0.01	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
11.00	0.02	12	0.23	0.01	**0.01**	0.00	**0.00**
12.00	**0.30**	**141**	**3.01**	**0.23**	0.01	**0.03**	**0.19**
13.00	**0.02**	**102**	**2.04**	**0.02**	0.01	**0.00**	0.01
14.00	0.01	100	2.01	0.01	0.01	0.00	0.00
15.00	0.01	96	1.92	0.01	0.01	0.00	0.00
16.00	0.01	84	1.67	0.01	0.01	0.00	0.00
17.00	0.01	66	1.31	0.01	0.01	0.00	0.00
18.00	0.01	44	0.88	0.01	0.01	0.00	0.00
19.00	0.01	20	0.39	0.01	0.01	0.00	0.00
20.00	0.01	0	0.00	0.01	0.01	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 0.15" for Storm Event event
Inflow = 0.02 cfs @ 12.01 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.03 hrs, Volume= 0.001 af, Atten= 29%, Lag= 1.1 min
Discarded = 0.01 cfs @ 12.03 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 0.03' @ 12.05 hrs Surf.Area= 272 sf Storage= 2 cf

Plug-Flow detention time= 0.8 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (852.1 - 851.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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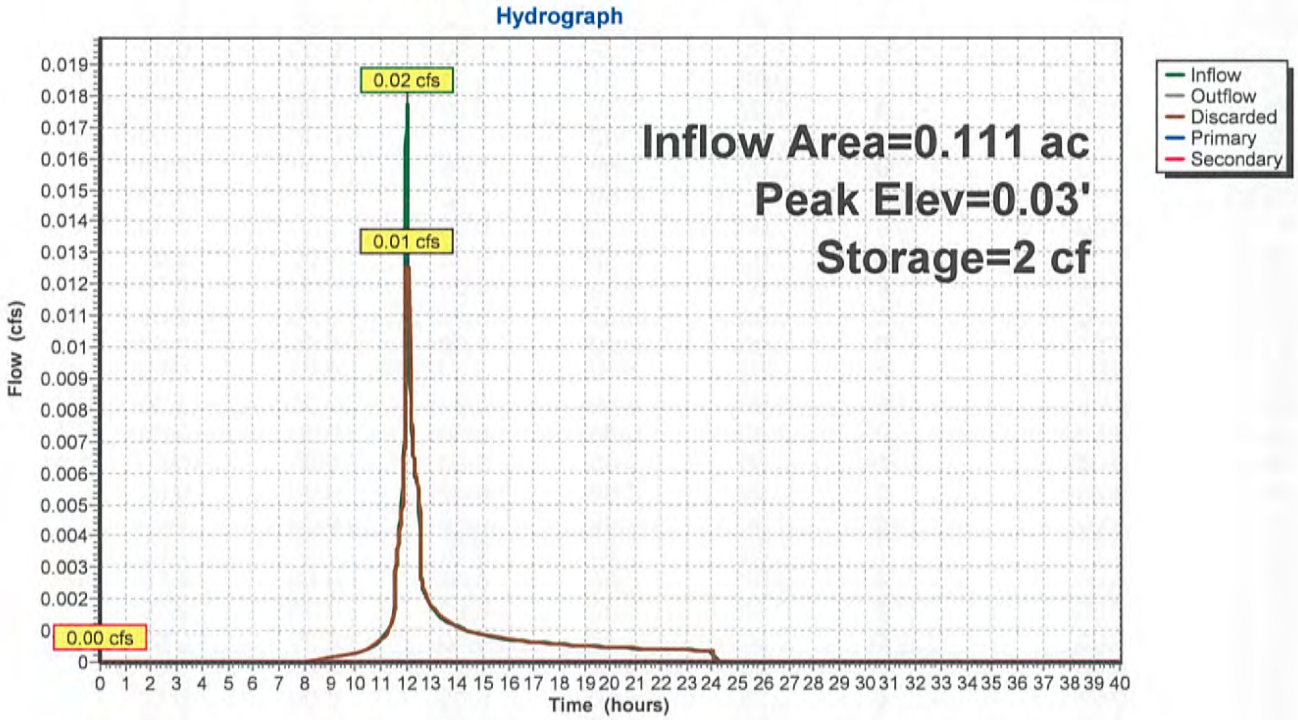
Discarded OutFlow Max=0.01 cfs @ 12.03 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└**4=Perforated Pipe** (Controls 0.00 cfs)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	**0.00**
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.00	0	0.00	0.00	0.00	0.00	0.00
12.00	**0.02**	**1**	**0.02**	**0.01**	**0.01**	0.00	0.00
13.00	**0.00**	**0**	**0.00**	**0.00**	**0.00**	0.00	0.00
14.00	0.00	0	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0	0.00	0.00	0.00	0.00	0.00
16.00	0.00	0	0.00	0.00	0.00	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**

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Summary for Pond 8P: East Basin- 100 Silva Cells

Inflow Area = 0.111 ac,100.00% Impervious, Inflow Depth = 0.69" for WQ event
Inflow = 0.08 cfs @ 12.01 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 11.61 hrs, Volume= 0.006 af, Atten= 85%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.61 hrs, Volume= 0.006 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 1.49' @ 12.56 hrs Surf.Area= 272 sf Storage= 74 cf

Plug-Flow detention time= 33.1 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 33.1 min (830.5 - 797.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	127 cf	**DeepRoot Silva Cell 20% x2** x 33 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 700 cf Overall - 12 cf Embedded = 127 cf
#2	2.00'	9 cf	**6.0" Round Pipe Storage** Inside #1 L= 45.0' 12 cf Overall - 0.5" Wall Thickness = 9 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		160 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet Overflow** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" W x 1.4" H Vert. Perforated Pipe X 50.00** C= 0.600

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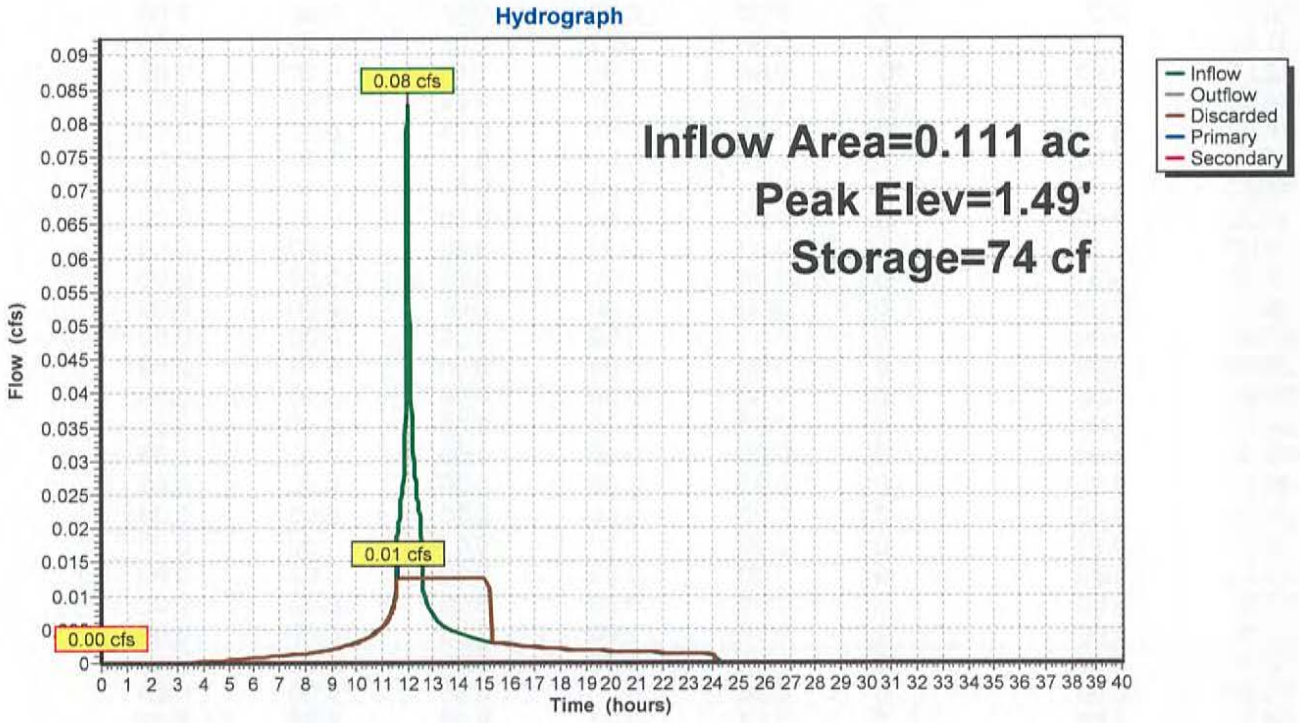
Discarded OutFlow Max=0.01 cfs @ 11.61 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet Overflow** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└**4=Perforated Pipe** (Controls 0.00 cfs)

Pond 8P: East Basin- 100 Silva Cells



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Hydrograph for Pond 8P: East Basin- 100 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	**0.00**
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.01	0	0.00	**0.01**	**0.01**	0.00	0.00
12.00	**0.08**	**32**	**0.64**	**0.01**	**0.01**	0.00	0.00
13.00	**0.01**	**68**	**1.36**	0.01	0.01	0.00	0.00
14.00	0.00	42	0.83	0.01	0.01	0.00	0.00
15.00	0.00	10	0.19	0.01	0.01	0.00	0.00
16.00	0.00	0	0.00	0.00	0.00	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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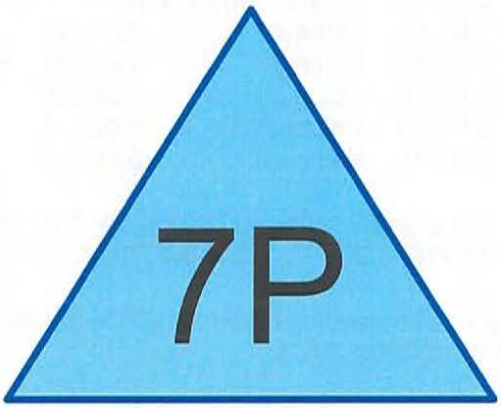
Stage-Discharge for Pond 8P: East Basin- 100 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.05	0.01	0.00	0.04
2.20	0.10	0.01	0.00	0.09
2.30	0.13	0.01	0.00	0.11
2.40	0.15	0.01	0.00	0.14
2.50	0.17	0.01	0.00	0.16
2.60	0.18	0.01	0.00	0.17
2.70	0.20	0.01	0.00	0.19
2.80	0.21	0.01	0.00	0.20
2.90	0.23	0.01	0.00	0.21
3.00	**0.24**	0.01	**0.00**	**0.23**



West Basin- 102 Silva Cells

Subcat Reach Pond Link

Routing Diagram for Boise_SilvaCell_Config1

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 1.08" for 2-Year event
Inflow = 0.07 cfs @ 12.01 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 11.66 hrs, Volume= 0.006 af, Atten= 80%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.66 hrs, Volume= 0.006 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 1.36' @ 12.61 hrs Surf.Area= 280 sf Storage= 70 cf

Plug-Flow detention time= 28.5 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 28.5 min (810.9 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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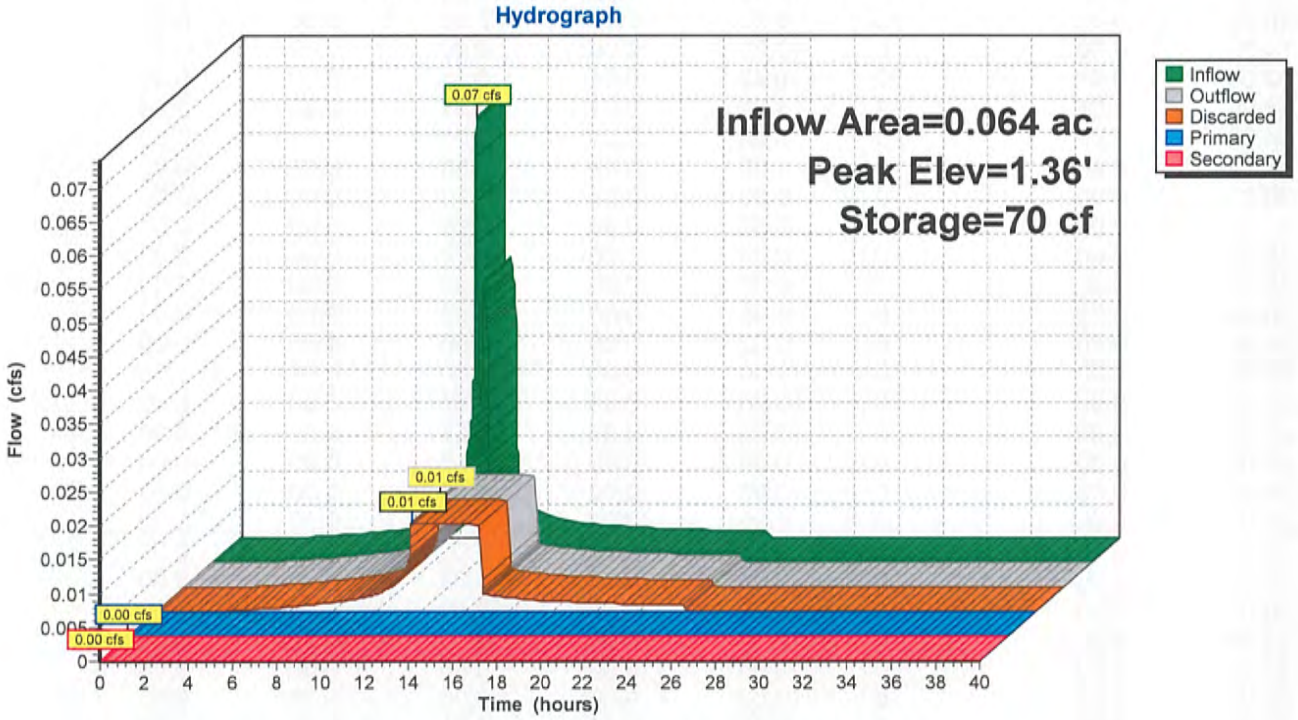
Discarded OutFlow Max=0.01 cfs @ 11.66 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**4=Perforated Pipe Orifices** (Controls 0.00 cfs)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	**0.00**
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.00	0	0.00	**0.00**	**0.00**	0.00	0.00
12.00	**0.07**	**22**	**0.42**	**0.01**	**0.01**	0.00	0.00
13.00	**0.01**	**62**	**1.20**	0.01	0.01	0.00	0.00
14.00	0.00	30	0.59	0.01	0.01	0.00	0.00
15.00	0.00	0	0.00	0.00	0.00	0.00	0.00
16.00	0.00	0	0.00	0.00	0.00	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 1.77" for 5-Year event
Inflow = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af
Outflow = 0.08 cfs @ 12.22 hrs, Volume= 0.009 af, Atten= 32%, Lag= 8.6 min
Discarded = 0.01 cfs @ 11.59 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.07 cfs @ 12.22 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.02' @ 12.22 hrs Surf.Area= 280 sf Storage= 104 cf

Plug-Flow detention time= 40.4 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 40.4 min (808.0 - 767.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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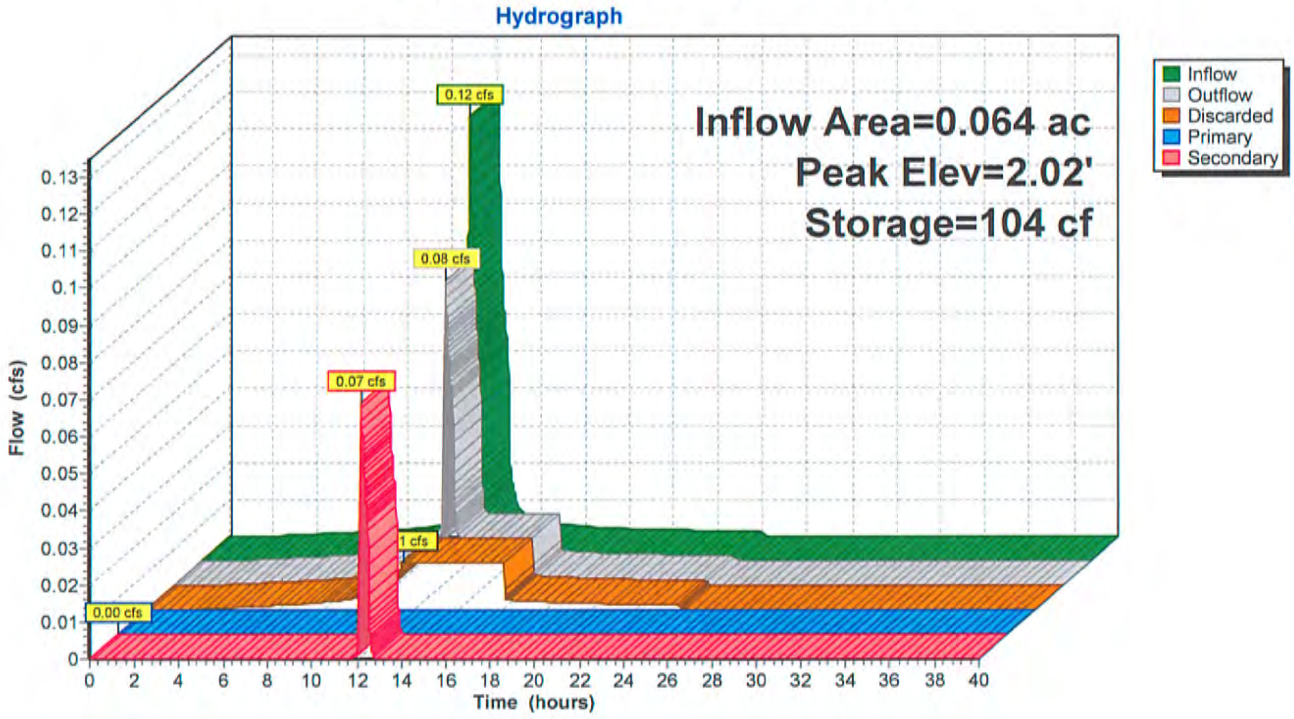
Discarded OutFlow Max=0.01 cfs @ 11.59 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.07 cfs @ 12.22 hrs HW=2.02' (Free Discharge)
└**4=Perforated Pipe Orifices** (Orifice Controls 0.07 cfs @ 0.71 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.01	0	0.00	0.01	**0.01**	0.00	0.00
12.00	**0.09**	**37**	**0.72**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.01**	**101**	**1.95**	**0.01**	0.01	0.00	**0.00**
14.00	0.00	75	1.45	0.01	0.01	0.00	0.00
15.00	0.00	42	0.82	0.01	0.01	0.00	0.00
16.00	0.00	7	0.13	0.01	0.01	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 0.24 cfs @ 12.02 hrs, Volume= 0.013 af
Outflow = 0.17 cfs @ 12.11 hrs, Volume= 0.013 af, Atten= 27%, Lag= 5.2 min
Discarded = 0.01 cfs @ 11.56 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.16 cfs @ 12.11 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.12' @ 12.11 hrs Surf.Area= 280 sf Storage= 111 cf

Plug-Flow detention time= 33.5 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 33.5 min (792.0 - 758.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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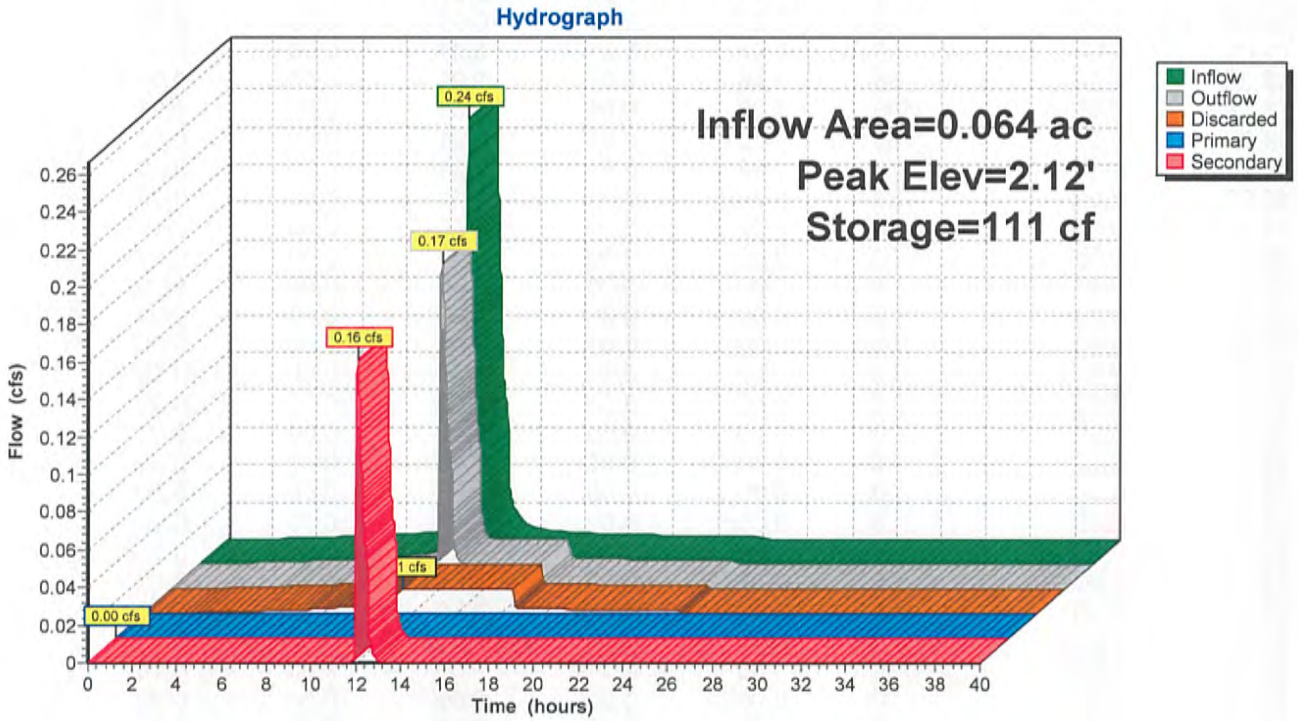
Discarded OutFlow Max=0.01 cfs @ 11.56 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.16 cfs @ 12.11 hrs HW=2.12' (Free Discharge)
└**4=Perforated Pipe Orifices** (Orifice Controls 0.16 cfs @ 1.66 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.22**	**65**	**1.26**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.01**	**103**	**2.00**	**0.01**	0.01	0.00	**0.00**
14.00	0.01	85	1.65	0.01	0.01	0.00	0.00
15.00	0.00	56	1.08	0.01	0.01	0.00	0.00
16.00	0.00	23	0.44	0.01	0.01	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 3.01" for 25-Year event
Inflow = 0.33 cfs @ 12.04 hrs, Volume= 0.016 af
Outflow = 0.24 cfs @ 12.06 hrs, Volume= 0.016 af, Atten= 27%, Lag= 1.4 min
Discarded = 0.01 cfs @ 11.55 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.23 cfs @ 12.06 hrs, Volume= 0.007 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.23' @ 12.06 hrs Surf.Area= 280 sf Storage= 120 cf

Plug-Flow detention time= 30.1 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 30.1 min (784.3 - 754.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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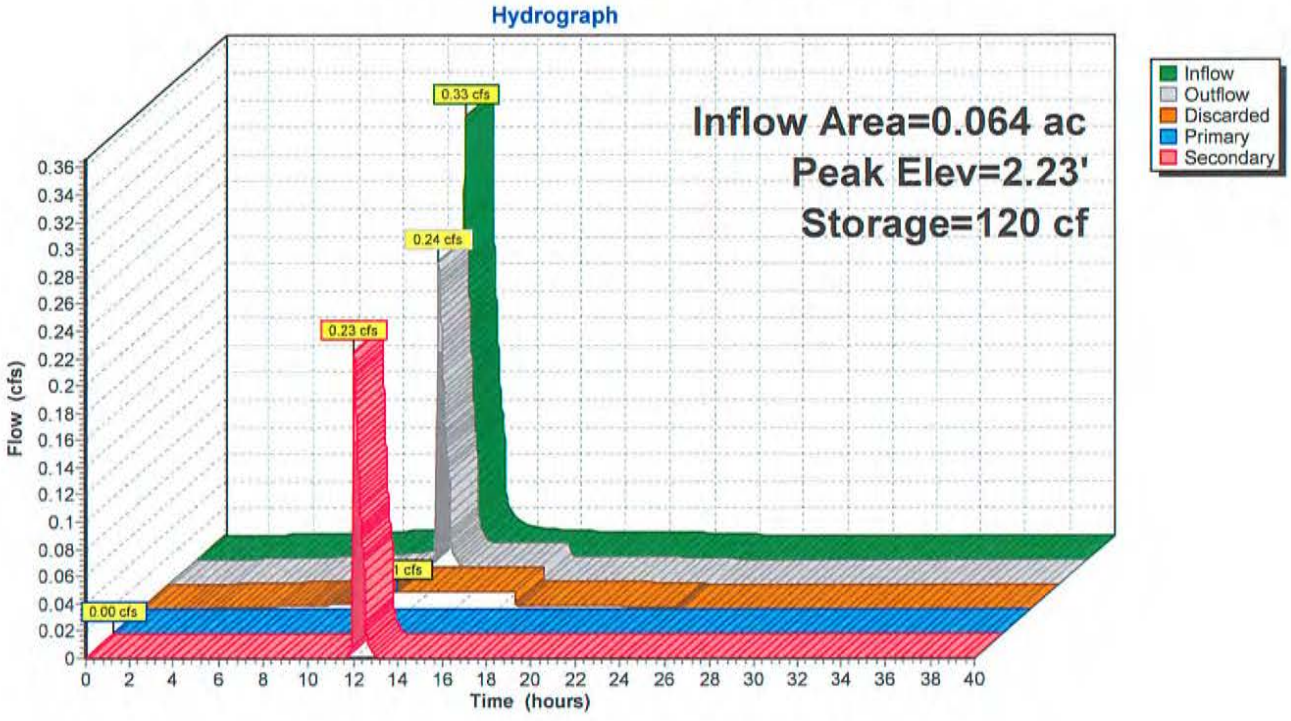
Discarded OutFlow Max=0.01 cfs @ 11.55 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└─**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.22 cfs @ 12.06 hrs HW=2.23' (Free Discharge)
└─**4=Perforated Pipe Orifices** (Orifice Controls 0.22 cfs @ 2.31 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.01	0	0.00	0.01	0.01	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.28**	**97**	**1.88**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.02**	**103**	**2.00**	**0.02**	0.01	0.00	**0.00**
14.00	0.01	88	1.71	0.01	0.01	0.00	0.00
15.00	0.00	60	1.17	0.01	0.01	0.00	0.00
16.00	0.00	28	0.54	0.01	0.01	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 3.06" for 30-Year event
Inflow = 0.28 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.22 cfs @ 12.06 hrs, Volume= 0.016 af, Atten= 20%, Lag= 3.0 min
Discarded = 0.01 cfs @ 11.53 hrs, Volume= 0.010 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.21 cfs @ 12.06 hrs, Volume= 0.006 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.20' @ 12.06 hrs Surf.Area= 280 sf Storage= 118 cf

Plug-Flow detention time= 31.0 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 31.0 min (786.3 - 755.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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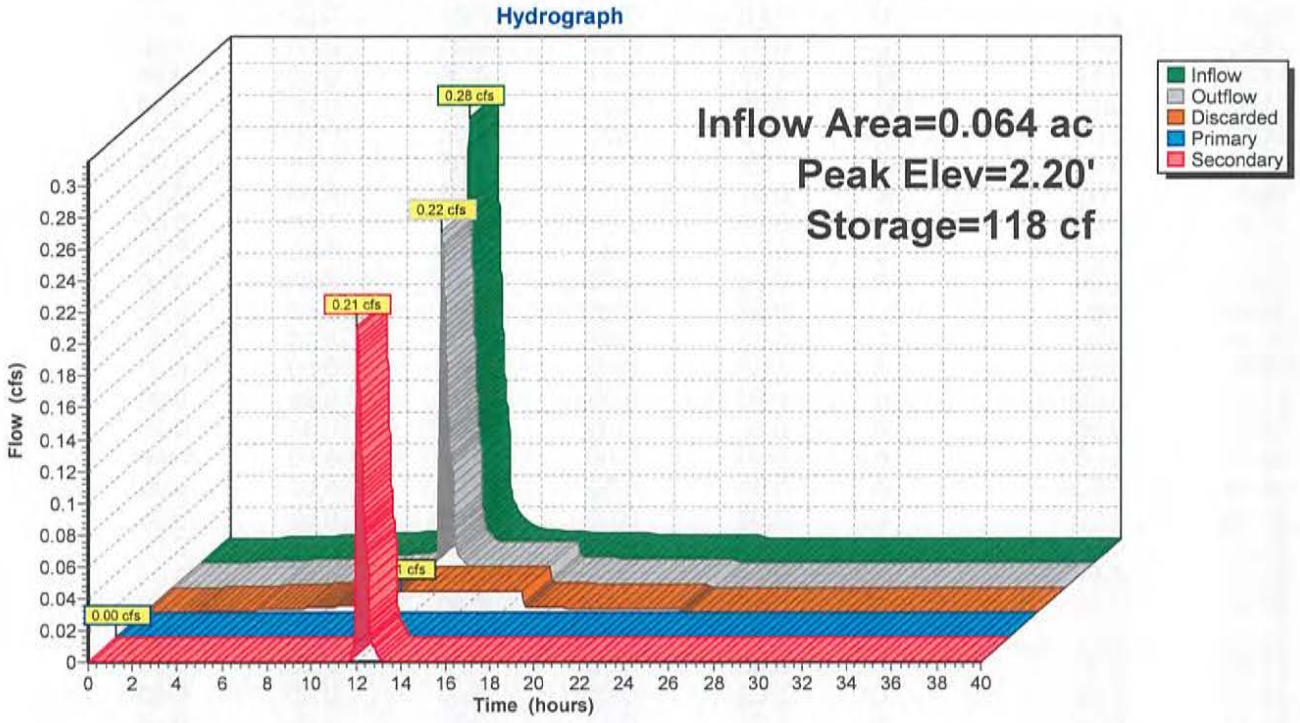
Discarded OutFlow Max=0.01 cfs @ 11.53 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.21 cfs @ 12.06 hrs HW=2.20' (Free Discharge)
└**4=Perforated Pipe Orifices** (Orifice Controls 0.21 cfs @ 2.17 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.01	0	0.00	0.01	0.01	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.27**	**92**	**1.79**	**0.01**	**0.01**	0.00	**0.00**
13.00	**0.02**	**103**	**2.00**	**0.02**	0.01	0.00	**0.00**
14.00	0.01	92	1.78	0.01	0.01	0.00	0.00
15.00	0.00	65	1.26	0.01	0.01	0.00	0.00
16.00	0.00	34	0.67	0.01	0.01	0.00	0.00
17.00	0.00	1	0.02	0.01	0.01	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 3.71" for 50-Year event
Inflow = 0.37 cfs @ 12.00 hrs, Volume= 0.020 af
Outflow = 0.29 cfs @ 12.06 hrs, Volume= 0.020 af, Atten= 21%, Lag= 3.1 min
Discarded = 0.01 cfs @ 11.41 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.28 cfs @ 12.06 hrs, Volume= 0.009 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.36' @ 12.06 hrs Surf.Area= 280 sf Storage= 130 cf

Plug-Flow detention time= 28.6 min calculated for 0.020 af (100% of inflow)
Center-of-Mass det. time= 28.6 min (780.4 - 751.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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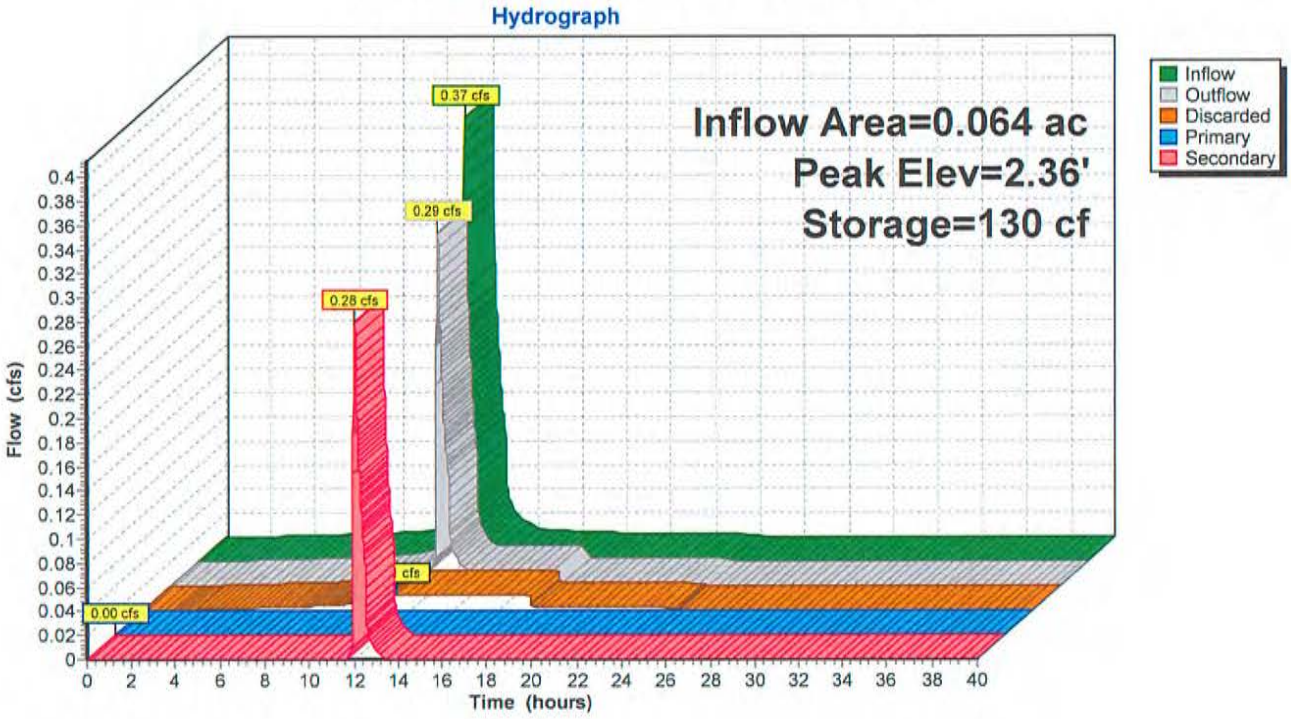
Discarded OutFlow Max=0.01 cfs @ 11.41 hrs HW=0.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└─**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.28 cfs @ 12.06 hrs HW=2.36' (Free Discharge)
└─**4=Perforated Pipe Orifices** (Orifice Controls 0.28 cfs @ 2.88 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.01	0	0.01	0.01	0.01	0.00	0.00
11.00	0.01	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.36**	**118**	**2.21**	**0.23**	**0.01**	0.00	**0.21**
13.00	0.02	**103**	**2.00**	**0.02**	0.01	0.00	**0.01**
14.00	0.01	98	1.90	0.01	0.01	0.00	0.00
15.00	0.01	74	1.44	0.01	0.01	0.00	0.00
16.00	0.00	45	0.88	0.01	0.01	0.00	0.00
17.00	0.00	14	0.26	0.01	0.01	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 4.12" for 100-Year event
Inflow = 0.38 cfs @ 11.98 hrs, Volume= 0.022 af
Outflow = 0.32 cfs @ 12.04 hrs, Volume= 0.022 af, Atten= 17%, Lag= 3.6 min
Discarded = 0.01 cfs @ 11.34 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.30 cfs @ 12.04 hrs, Volume= 0.011 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 2.42' @ 12.04 hrs Surf.Area= 280 sf Storage= 135 cf

Plug-Flow detention time= 27.2 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 27.2 min (776.9 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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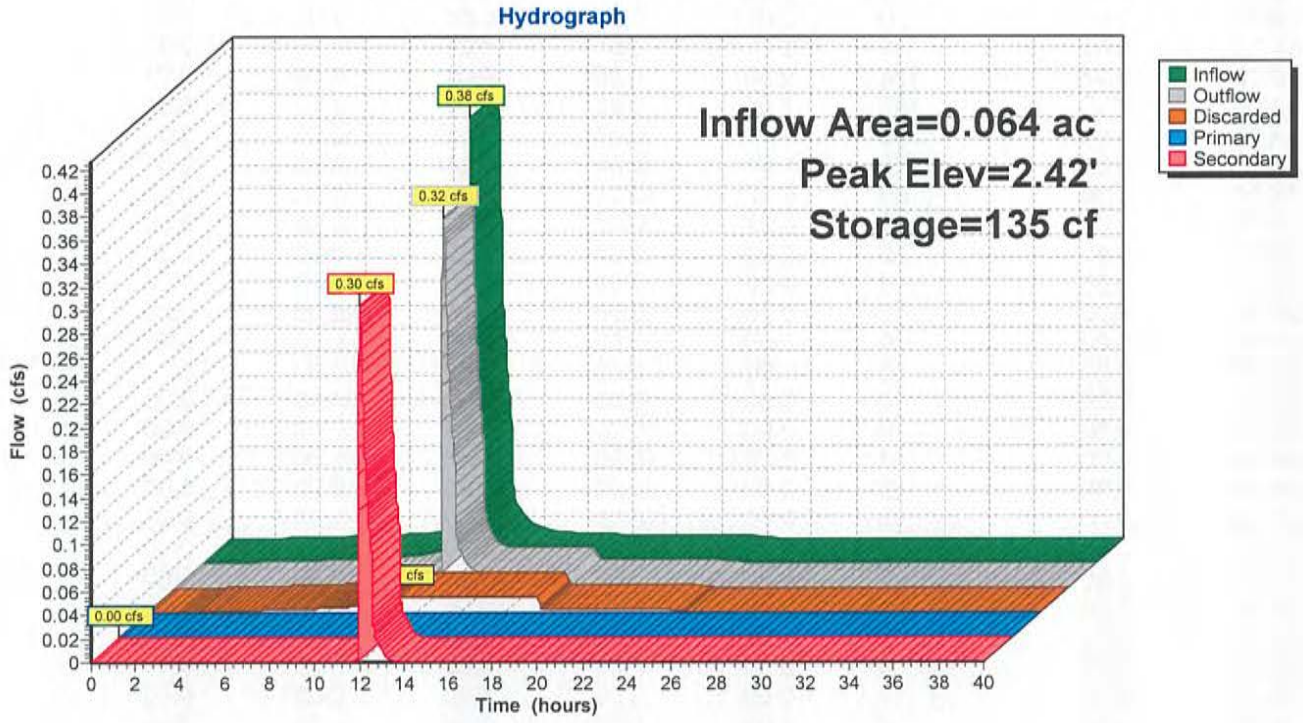
Discarded OutFlow Max=0.01 cfs @ 11.34 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.30 cfs @ 12.04 hrs HW=2.42' (Free Discharge)
└**4=Perforated Pipe Orifices** (Orifice Controls 0.30 cfs @ 3.12 fps)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	0.00
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.01	0	0.00	0.01	0.01	0.00	0.00
10.00	0.01	0	0.01	0.01	0.01	0.00	0.00
11.00	**0.01**	0	0.01	0.01	**0.01**	0.00	0.00
12.00	**0.37**	**128**	**2.33**	**0.28**	**0.01**	0.00	**0.27**
13.00	0.02	**103**	**2.00**	**0.02**	0.01	0.00	**0.01**
14.00	0.01	100	1.94	0.01	0.01	0.00	0.00
15.00	0.01	78	1.51	0.01	0.01	0.00	0.00
16.00	0.00	50	0.97	0.01	0.01	0.00	0.00
17.00	0.00	19	0.37	0.01	0.01	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 0.15" for Storm Event event
Inflow = 0.01 cfs @ 12.01 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af, Atten= 1%, Lag= 0.5 min
Discarded = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 0.01' @ 12.02 hrs Surf.Area= 280 sf Storage= 0 cf

Plug-Flow detention time= 0.7 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (852.0 - 851.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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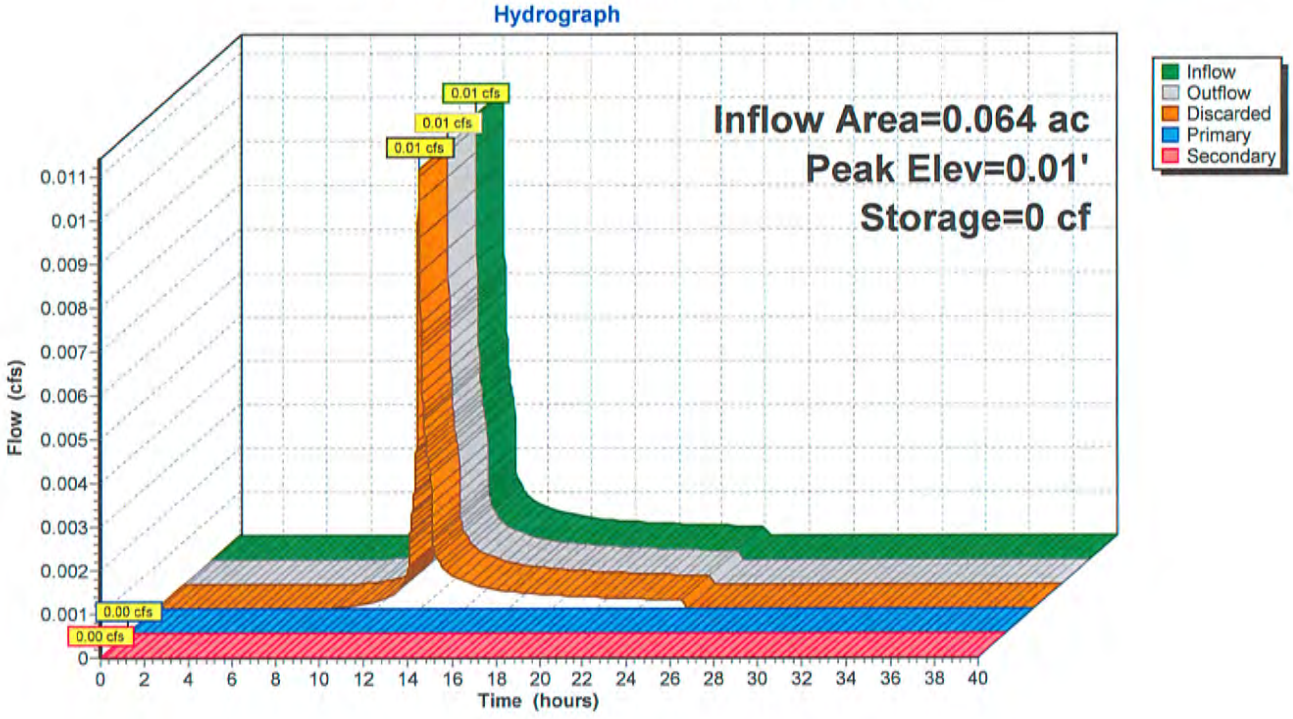
Discarded OutFlow Max=0.01 cfs @ 12.02 hrs HW=0.01' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└─**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**4=Perforated Pipe Orifices** (Controls 0.00 cfs)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	**0.00**
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.00	0	0.00	0.00	0.00	0.00	0.00
12.00	**0.01**	**0**	**0.01**	**0.01**	**0.01**	0.00	0.00
13.00	**0.00**	**0**	**0.00**	**0.00**	**0.00**	0.00	0.00
14.00	0.00	0	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0	0.00	0.00	0.00	0.00	0.00
16.00	0.00	0	0.00	0.00	0.00	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

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Summary for Pond 7P: West Basin- 102 Silva Cells

Inflow Area = 0.064 ac,100.00% Impervious, Inflow Depth = 0.69" for WQ event
Inflow = 0.05 cfs @ 12.01 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 11.86 hrs, Volume= 0.004 af, Atten= 73%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.86 hrs, Volume= 0.004 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.01 hrs / 5
Peak Elev= 0.46' @ 12.45 hrs Surf.Area= 280 sf Storage= 24 cf

Plug-Flow detention time= 8.4 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 8.4 min (805.8 - 797.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	129 cf	**DeepRoot Silva Cell 20% x2** x 34 Inside= 24.6"W x 30.9"H => 0.97 sf x 4.02'L = 3.9 cf Outside= 24.6"W x 30.9"H => 5.28 sf x 4.02'L = 21.2 cf 3 Rows of 11 Chambers 721 cf Overall - 20 cf Embedded = 129 cf
#2	2.00'	15 cf	**6.0" Round Pipe Storage** Inside #1 L= 75.0' 20 cf Overall - 0.5" Wall Thickness = 15 cf
#3	3.00'	25 cf	**Temporary overflow to street (Prismatic)** Listed below (Recalc)
		169 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
3.00	500	0	0
3.05	500	25	25

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.000 in/hr Exfiltration over Surface area below 2.57'** Phase-In= 0.01'
#2	Primary	3.00'	**12.0" x 24.0" Horiz. Drop Inlet (Overflow)** C= 0.600 Limited to weir flow at low heads
#3	Device 2	1.07'	**6.0" Horiz. Perforated Pipe Outlet to Drop Inlet** C= 0.600 Limited to weir flow at low heads
#4	Secondary	2.00'	**0.1" x 1.4" Horiz. Perforated Pipe Orifices X 100.00** C= 0.600 Limited to weir flow at low heads

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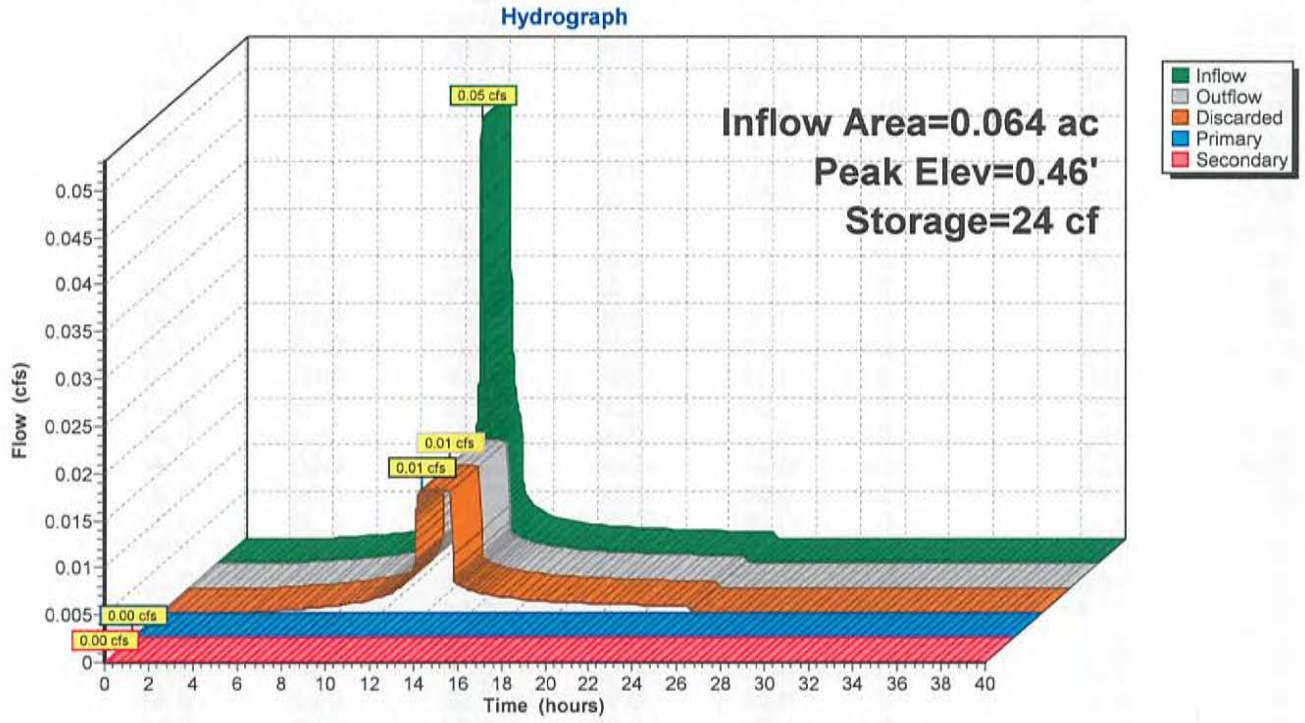
Discarded OutFlow Max=0.01 cfs @ 11.86 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**2=Drop Inlet (Overflow)** (Controls 0.00 cfs)
└**3=Perforated Pipe Outlet to Drop Inlet** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**4=Perforated Pipe Orifices** (Controls 0.00 cfs)

Pond 7P: West Basin- 102 Silva Cells



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Hydrograph for Pond 7P: West Basin- 102 Silva Cells

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	0.00	0.00	0.00	**0.00**	**0.00**
1.00	0.00	0	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0	0.00	0.00	0.00	0.00	0.00
4.00	0.00	0	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0	0.00	0.00	0.00	0.00	0.00
6.00	0.00	0	0.00	0.00	0.00	0.00	0.00
7.00	0.00	0	0.00	0.00	0.00	0.00	0.00
8.00	0.00	0	0.00	0.00	0.00	0.00	0.00
9.00	0.00	0	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0	0.00	0.00	0.00	0.00	0.00
11.00	0.00	0	0.00	**0.00**	**0.00**	0.00	0.00
12.00	**0.05**	**10**	**0.20**	**0.01**	**0.01**	0.00	0.00
13.00	**0.00**	**10**	**0.20**	0.01	0.01	0.00	0.00
14.00	0.00	0	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0	0.00	0.00	0.00	0.00	0.00
16.00	0.00	0	0.00	0.00	0.00	0.00	0.00
17.00	0.00	0	0.00	0.00	0.00	0.00	0.00
18.00	0.00	0	0.00	0.00	0.00	0.00	0.00
19.00	0.00	0	0.00	0.00	0.00	0.00	0.00
20.00	0.00	0	0.00	0.00	0.00	0.00	0.00
21.00	0.00	0	0.00	0.00	0.00	0.00	0.00
22.00	0.00	0	0.00	0.00	0.00	0.00	0.00
23.00	0.00	0	0.00	0.00	0.00	0.00	0.00
24.00	0.00	0	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0	0.00	0.00	0.00	0.00	0.00
26.00	0.00	0	0.00	0.00	0.00	0.00	0.00
27.00	0.00	0	0.00	0.00	0.00	0.00	0.00
28.00	0.00	0	0.00	0.00	0.00	0.00	0.00
29.00	0.00	0	0.00	0.00	0.00	0.00	0.00
30.00	0.00	0	0.00	0.00	0.00	0.00	0.00
31.00	0.00	0	0.00	0.00	0.00	0.00	0.00
32.00	0.00	0	0.00	0.00	0.00	0.00	0.00
33.00	0.00	0	0.00	0.00	0.00	0.00	0.00
34.00	0.00	0	0.00	0.00	0.00	0.00	0.00
35.00	0.00	0	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0	0.00	0.00	0.00	0.00	0.00
37.00	0.00	0	0.00	0.00	0.00	0.00	0.00
38.00	0.00	0	0.00	0.00	0.00	0.00	0.00
39.00	0.00	0	0.00	0.00	0.00	0.00	0.00
40.00	0.00	0	0.00	0.00	0.00	0.00	0.00

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Stage-Discharge for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	**0.00**	0.00	0.00
0.10	0.01	**0.01**	0.00	0.00
0.20	0.01	0.01	0.00	0.00
0.30	0.01	0.01	0.00	0.00
0.40	0.01	0.01	0.00	0.00
0.50	0.01	0.01	0.00	0.00
0.60	0.01	0.01	0.00	0.00
0.70	0.01	0.01	0.00	0.00
0.80	0.01	0.01	0.00	0.00
0.90	0.01	0.01	0.00	0.00
1.00	0.01	0.01	0.00	0.00
1.10	0.01	0.01	0.00	0.00
1.20	0.01	0.01	0.00	0.00
1.30	0.01	0.01	0.00	0.00
1.40	0.01	0.01	0.00	0.00
1.50	0.01	0.01	0.00	0.00
1.60	0.01	0.01	0.00	0.00
1.70	0.01	0.01	0.00	0.00
1.80	0.01	0.01	0.00	0.00
1.90	0.01	0.01	0.00	0.00
2.00	0.01	0.01	0.00	0.00
2.10	0.16	0.01	0.00	0.15
2.20	0.22	0.01	0.00	0.21
2.30	0.27	0.01	0.00	0.26
2.40	0.31	0.01	0.00	0.30
2.50	0.34	0.01	0.00	0.33
2.60	0.38	0.01	0.00	0.36
2.70	0.40	0.01	0.00	0.39
2.80	0.43	0.01	0.00	0.42
2.90	0.46	0.01	0.00	0.44
3.00	**0.48**	0.01	**0.00**	**0.47**

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Stage-Area-Storage for Pond 7P: West Basin- 102 Silva Cells

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
0.00	280	0
0.05	280	3
0.10	280	5
0.15	280	8
0.20	280	10
0.25	280	13
0.30	280	15
0.35	280	18
0.40	280	21
0.45	280	23
0.50	280	26
0.55	280	28
0.60	280	31
0.65	280	33
0.70	280	36
0.75	280	39
0.80	280	41
0.85	280	44
0.90	280	46
0.95	280	49
1.00	280	52
1.05	280	54
1.10	280	57
1.15	280	59
1.20	280	62
1.25	280	64
1.30	280	67
1.35	280	70
1.40	280	72
1.45	280	75
1.50	280	77
1.55	280	80
1.60	280	82
1.65	280	85
1.70	280	88
1.75	280	90
1.80	280	93
1.85	280	95
1.90	280	98
1.95	280	100
2.00	280	103
2.05	280	106
2.10	280	110
2.15	280	113
2.20	280	117
2.25	280	121
2.30	280	125
2.35	280	129
2.40	280	133
2.45	280	137
2.50	280	140
2.55	280	142
2.60	0	144
2.65	0	144
2.70	0	144
2.75	0	144
2.80	0	144
2.85	0	144
2.90	0	144
2.95	0	144
3.00	**500**	144
3.05	500	**169**

Appendix 16
Dry Weather Outfall Screening Plan

Dry Weather Outfall Screening Plan

Prepared for

Ada County Highway District

Boise, Idaho

November 20, 2017

Version 1.2

Dry Weather Outfall Screening Plan

Prepared for

Ada County Highway District Boise, Idaho

November 20, 2017

Version 1.2

Brown AND Caldwell

950 West Bannock Street, Suite 250

Boise, Idaho 83702

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List of Abbreviations

ACHD	Ada County Highway District
BOD	Biological Oxygen Demand – 5 day
CFR	Code of Federal Regulations
COC	Chain of Custody
DO	Dissolved Oxygen
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	Environmental Protection Agency
MDL	Method Detection Limit
mL	Milliliter
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
PMEP	Project Monitoring and Evaluation Plan
PRDL	Project Required Detection Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
WQL	Boise City Water Quality Laboratory

Executive Summary

The National Pollutant Discharge Elimination System (NPDES) Phase I Permit No. IDS-027561 (Permit) was issued effective February 1, 2013, to Ada County Highway District (ACHD), Boise State University, City of Boise, City of Garden City, Drainage District #3, and the Idaho Transportation Department District #3, referred to as the "Permittees." Under this permit, the Permittees are required to implement and update as necessary, a dry weather analytical and field screening monitoring program consistent with the monitoring and evaluation program objectives as described in Permit Part IV.A.2 and the requirements outlined in Permit Part II.B.5.d "Dry Weather Outfall Screening Program". This Dry Weather Outfall Screening Plan has been developed to fulfill these permit requirements for outfalls owned by ACHD and outfalls of unknown ownership. The outfall inventory statistics and information documented in this plan are limited to outfalls under ACHD and unknown Ownership and do not account for all permittee owned outfalls.

This plan follows the general guidance of the Project Monitoring and Evaluation Plan (PMEP) (ACHD, 2013) and the Quality Assurance Program Plan for NPDES Storm Water Permit Monitoring (QAPP) (ACHD, 2014). The previous NPDES phase I permit, issued in 2000, focused on outfall identification, inventory development, and information verification. The current permit expands on that information to focus on analytical and field screening to detect and eliminate illicit discharges. This plan describes the overall approach to dry weather outfall screening and provides comprehensive guidance for outfall investigation efforts, including prioritization of outfalls, data collection efforts, recordkeeping, and reporting activities.

Certain Quality Assurance/Quality Control (QA/QC) procedures that have been identified using United States Environmental Protection Agency (EPA) guidance for QAPPs are also included in this plan. The QA/QC procedures are designed to ensure data collected meet specific data quality objectives developed specifically for Permit-required monitoring activities. The plan documents QC sampling procedures, data acceptance criteria, and data management details specific to the Dry Weather Outfall Screening Plan.

Section 1

Introduction

1.1 Basis for Dry Weather Outfall Screening Plan

The Permit requires that the Permittees implement a dry weather analytical and field screening monitoring program that emphasizes frequent, geographically widespread monitoring to detect illicit discharges and illegal connections and to reinvestigate potentially problematic outfalls. The Dry Weather Outfall Screening Plan is designed to be consistent with the monitoring and evaluation program objectives described in the PMEP. Permit requirements specific to the dry weather outfall screening program include the following:

- **Outfall Identification (Part II.B.5.d.i).** Update the stormwater outfall identification and screening plan including reconnaissance activities, information used to prioritize outfalls for screening, ACHD's approach to conducting analyses on identified flows, and the trigger thresholds for follow-up action.
- **Monitoring Illicit Discharges (Part II.B.5.d.ii).** Conduct monitoring at least once annually following the criteria outlined in the Permit.
- **Maintain Records of Dry Weather Screening (Part II.B.5.d.iii).** Keep detailed records of dry weather outfall screening activities and results and document follow-up activities.

1.2 Plan Objectives

The Dry Weather Outfall Screening Plan addresses the minimum permit requirements for dry weather outfall screening and outfall identification as described in Permit Part II.B.5.d. In addition the plan has been developed considering the level of service goals and objectives identified in the PMEP. This plan provides guidance for field reconnaissance activities, monitoring, and recordkeeping efforts performed by ACHD. To standardize ACHD's approach to addressing quality assurance recommendations by the EPA for all monitoring programs under the Permit, each quality assurance element is addressed as either a program element or a screening plan element.

Dry Weather Outfall Screening Plan elements are described in full in this document, while elements applicable to all monitoring programs under the Permit are addressed in the QAPP. Plan organization, responsibilities, and objectives are derived from the PMEP, which serves as guidance to standardize stormwater management under this Permit as a whole, including the approach to quality assurance and screening plan implementation. Monitoring program elements consist of the standardized monitoring components that all individual monitoring or screening plans developed under the Permit reference. A list of program and screening plan elements is included in Table 1-1.

Table 1-1. QAPP Element Document Reference		
EPA-Recommended QAPP Elements	Monitoring Program Element (Addressed in the QAPP)	Dry Weather Outfall Screening Plan Element; Section
Group A: Project Management		
A1 – Title and Approval Sheet	X	
A2 – Table of Contents	X	
A3 – Distribution List	X	
A4a – Project Organization	X	
A4b – Task Organization		X; 1.3
A5 – Problem Definition/Background	X	
A6 – Project/Task Description		X; 1.2
A7a – Quality Objectives and Criteria for Measurement Data	X	
A7b – Method-Dependent Criteria for Measurement Data		X; 5.2
A8 – Special Training Needs/Certification	X	
A9 – Documents and Records	X	
Group B: Data Generation and Acquisition		
B1 – Sampling Process and Design		X; 2
B2 – Sampling Methods		X; 3, 4.3
B3 – Sample Handling and Custody		X; 4.3.2
B4 – Analytical Methods		X; 4.3.1
B5a – Quality Control	X	
B5b – QA/QC Sampling Schedule		X; 5.1
B6 – Instrument/Equipment Testing, Inspection, and Maintenance		X; 3
B7 – Instrument/Equipment Calibration and Frequency		X; 3
B8 – Inspection/Acceptance of Supplies and Consumables	X	
B9 – Non-direct Measurements	X	
B10 – Data Management	X	
Group C: Assessment and Oversight		
C1 – Assessments and Response Actions	X	
C2 – Reports to Management	X	
Group D: Data Validation and Usability		
D1 – Data Review, Verification, and Validation	X	
D2 – Verification and Validation Methods	X	
D3 – Reconciliation and User Requirements	X	

1.3 Task Organization

Key roles and job functions are described in the QAPP. The dry weather outfall screening program organization chart is presented in Figure 1-1.

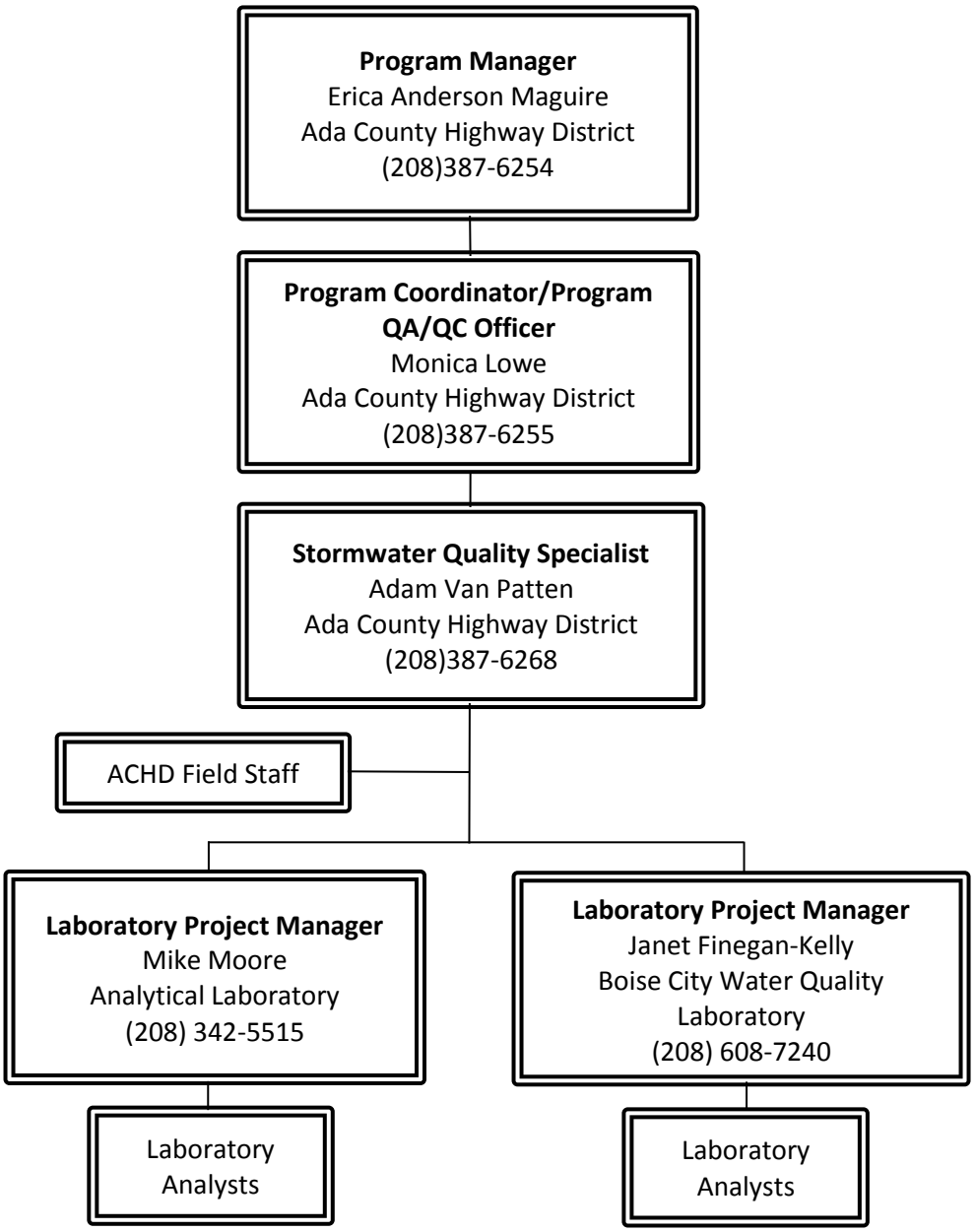

Figure 1-1. Dry weather outfall screening organization chart

Section 2

Screening Process Design

The screening process design consists of the planned and consistent approach to screening the outfalls of the Municipal Separate Storm Sewer System (MS4) to detect illicit discharges and illegal connections. The screening process has been developed to enable ACHD to inspect all outfalls owned by ACHD over the course of a five year period. The screening process includes provisions for prioritizing and sorting the outfalls to be screened such that investigations conducted each year are distributed across the Permit area and that all major land uses are represented.

Data collection includes qualitative characteristics of the outfalls, flow measurements, water quality data, and information useful in tracing flow to the source and eliminating illicit discharges and illegal connections. Section 2.1 provides a description of the information currently available for outfalls owned by ACHD. Section 2.2 describes ACHD's approach to prioritizing outfall screening in each year and across the five year period during which all outfalls owned by ACHD will be screened. This allows ACHD to meet the permit requirement of screening 20 percent or more of the total outfalls each year. Project details addressing data collection efforts including monitoring equipment used, outfall assessment procedures, and flow monitoring methods are included in sections 3 and 4.

2.1 Outfall Screening Locations

Ada County Highway District owns a total of 742 documented outfalls across the NPDES Phase I Permit area. Outfalls drain all major land uses within the Permit area and have the potential to convey illicit discharges to receiving waters. Figure 2-1 shows all Permittee-owned outfalls within the Permit area (Figures Section).

ACHD outfalls discharge to a total of 68 different Waters of the U.S. within the Permit area. Table 2-1 (Tables Section) includes a list of receiving waters in the Permit area and the number of outfalls discharging to each. Specific reaches of a number of the receiving waters are listed as impaired waters on the Idaho Department of Environmental Quality 303d list. These waters and the pollutants of concern associated with impairment are included in Table 2-2 (Tables Section).

2.2 Outfall Prioritization and Screening Schedule

Planned prioritization of outfalls selected for screening helps to ensure that Permit requirements are met in the outfalls screened each year. The prioritization levels described below have been established for use in selecting outfalls for screening each year. The requirements described in Permit Part II.B.5.d.ii for monitoring illicit discharges have been compared with the information summarized in Section 2.1 to prioritize the targeted outfalls and develop a schedule to screen 20 percent of the outfalls annually.

Figure 2-2 represents a summary of the approach ACHD has developed to conduct screening in accordance with the requirements of Permit part II.B.5.d.ii. The outfall screening schedule includes 20 percent of the total ACHD-owned outfalls each year, of which, at least 20 percent the outfalls discharge to impaired waters. At least one third of the outfalls will be screened during the June 1 to September 30 time frame of each year.

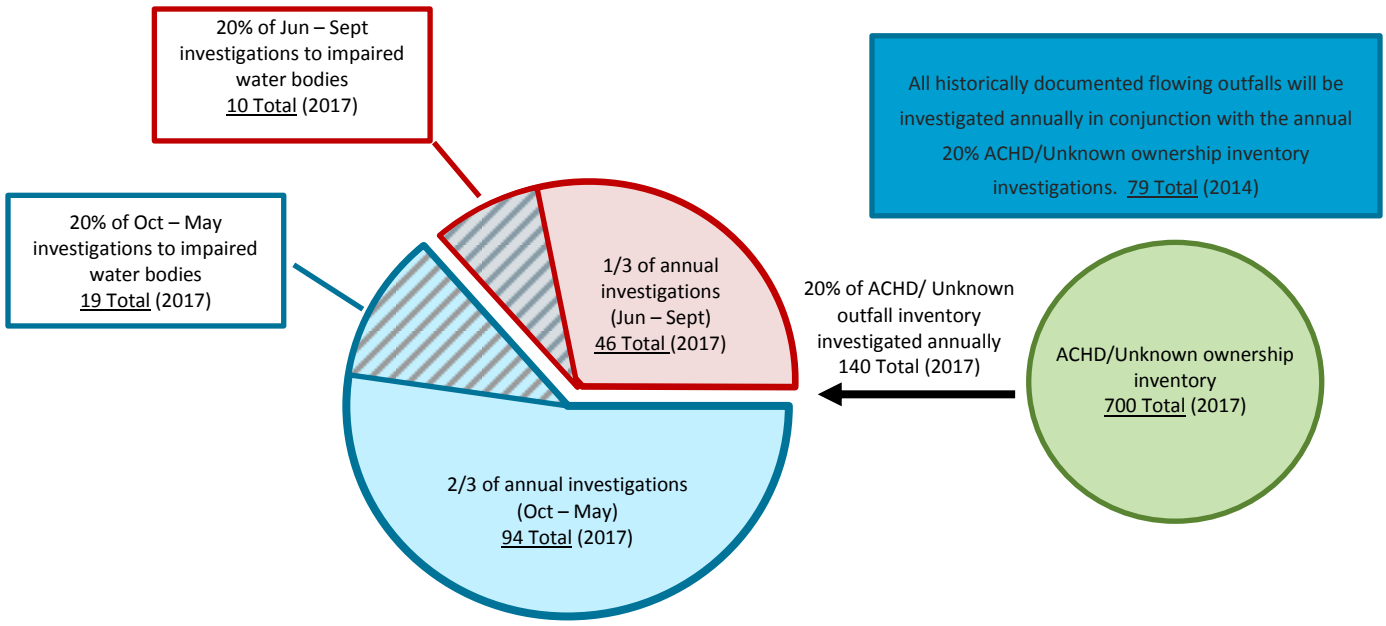

Figure 2-2 Outfall screening schedule organization

Prioritization

Outfalls given the highest priority include documented flowing outfalls and outfalls to impaired water bodies. Each year priority will be given to outfalls that are the subject of public complaints or that the ACHD personnel believe may have an increased illicit discharge potential whether or not they were originally scheduled for that given year. Examples of increased risk include identification of cross connections, problems with aging infrastructure, or activities and conditions in the drainage area likely to result in an illicit discharge. In these instances the outfalls originally scheduled for investigation will be rescheduled for a later date to maintain the goal of 20 percent of total outfalls screened each year.

Previously Documented Flows

Flowing outfalls discharging irrigation or groundwater seepage flows that have already been identified will be sampled annually to assess compliance with Permit Part I.D. ACHD has documented 79 outfalls discharging irrigation or groundwater flows within the Permit area. If analytical and field investigation results indicate that the flow is in compliance with Permit Part I.D, the outfall will be removed from the annual historical flow sampling list.

Investigations of previously documented flows are to be completed annually and are not limited to specific times of the year. However, ACHD has observed seasonal variation in these flows typically attributable to irrigation and high groundwater. The intent of ACHD's sampling approach is to address such flows by first assessing flow origin and date of observance.

Substantial flows that are believed to be continuous will be reinvestigated up to two times during the first year to collect additional flow measurements and to document the approximate duration of the year that the flows are present. Investigations will be scheduled in an attempt to determine the duration of the year the flows are present. Outfalls with lower flows or intermittent flows may be reinvestigated as time allows at a lower priority level. Previously documented flowing outfalls will only be counted as part of the 20 percent of total outfalls screened annually if there is an overlap between the flowing outfalls and the 20 percent selected for that year.

Each year, following preparation of the annual report, the schedule for investigation of flowing outfalls will be revised based on the previous year's results. This approach is described in greater detail in Section 6.3.2 Annual Reporting.

Screening Schedule

Appendix A is the screening schedule for all documented outfalls, which includes all ACHD-owned and unknown outfalls within the phase I Permit area. The screening schedule is based on geographic distribution and the prioritization methods described above. This schedule has been developed to ensure that Permit requirements for outfall screening are met for each year. The schedule will be updated at least once each year to reflect any changes in total number of outfalls and outfalls rescheduled due to prioritization needs during each year.

Section 3

Monitoring Equipment

This section provides an overview of the types of monitoring equipment planned for use in the dry weather outfall screening program. Standard Operating Procedures (SOPs) and procedure guidance documents are included in Appendix B and provide greater detail describing how equipment is used to accomplish the goals of the Dry Weather Outfall Screening Program. Manufacturers' recommendations for proper use and maintenance are either included in the SOPs or the equipment manuals referenced in the SOPs.

3.1 Stormwater Test Kit

ACHD utilizes the Hach Stormwater Test Kit for in-field chemical analysis of total chlorine, total copper, and total phenols. Chemical analyses are conducted according to the manufacturer's instructions (Appendix B) using colorimetric comparison of samples treated with reagents to estimate concentration of the constituents of concern. The test kit includes dissolvable, premeasured reagent packets specific to each chemical analysis, viewing tubes, and a color comparator, which holds the viewing tubes in line with a rotating color wheel. The kit also includes a long path viewing adaptor to accommodate the full range of targeted chemical analyses with an incremental accuracy of 0.1 mg/L.

Calibration and Maintenance

A check of reagent accuracy can be completed using a reagent specific standard solution. Accuracy will be tested for each packet of reagents used following the test procedures outlined in Appendix B. ACHD is responsible for calibration and maintenance and will keep a log in the monitoring shed for reference.

Color viewing tubes and containers and utensils used for mixing samples will be rinsed with deionized water immediately after sample results are recorded for each analysis. The stormwater test kit will be kept dry and reagent packets will be kept in water-resistant containers between uses.

3.2 Flow Probe

ACHD utilizes a Global Water FP111 Flow Probe for collecting velocity measurements used in estimating discharge volume of flowing outfalls. The velocity meter uses a propeller attached to a telescoping handle. The propeller is protected by a plastic shield that extends around the outer diameter of the propeller to avoid bumping the propeller against the bottom of the pipe/channel or other obstacles.

A small computer with an LCD screen is attached to the handle opposite the propeller. The computer displays velocity as an instantaneous measurement as well as the minimum, maximum, and average velocity readings. The flow probe computer is zeroed out immediately prior to collect new readings.

Discharge flow measurement using the Global Water Flow Probe is discussed in detail in Section 4.3.3. If another flow probe is substituted for the Global Water Flow Probe, the substitute will be verified to have the same or higher degree of sensitivity and accuracy.

Calibration and Maintenance

Per the manufacturer's recommendations the flow probe will be allowed to dry between uses and washed with soap as needed to maintain proper operation. The flow probe does not require routine maintenance or calibration other than being kept clean.

3.3 Handheld Field Parameter Instruments

During discharge sample collection, specific parameters will be measured directly in the field using a variety of handheld instruments to collect readings including: pH, conductivity, dissolved oxygen content, and temperature. Measurements of field parameters will be collected immediately after sample collection. If parameters are measured more than 15 minutes after sample collection the data will be qualified. Field parameter instruments will be rinsed with distilled water between measurements.

Handheld field parameter instruments may include the following specific instruments. If any other instrument is substituted for an instrument listed below, the substitute will be verified to have the same or higher degree of sensitivity to maintain data quality and program safety objectives. The following is a list of program approved instruments.

- Horiba D-51 pH/temperature meter
- YSI-85 DO/salinity/conductivity/temperature meter
- Hach 2100Q turbidity meter

Safety Monitoring Instruments:

- Hazardous vapor monitors including: Biosystems PhD Lite, Biosystems PHD6, and Sperian

Calibration and Maintenance

Maintenance will be conducted per manufacturers' recommendations and the procedures outlined in Appendix B, or more frequently as warranted by equipment performance. Instruments will be inspected and calibrated before each planned sampling event. ACHD is responsible for calibration and maintenance and will keep a log in the monitoring shed for reference.

Section 4

Screening and Sampling Procedures

4.1 Weather Information and Field Preparation

Permit requirements for dry weather outfall screening require an antecedent dry period of 72 hours or more of 0.10 inch or less of precipitation. In order to meet this criteria, staff will verify the antecedent dry period by accessing continuous weather observations published by the National Weather Service (NWS) for the weather monitoring station located at the Boise Airport. Observations may be obtained by visiting the NWS webpage for the local area or by calling the NWS Boise office. While confirming the antecedent dry period, staff will also check the forecast for the area where work is planned to ensure acceptable and safe weather conditions are present during screening.

Field equipment and supplies may vary based on the location and type of terrain expected to access outfall(s) planned for investigation. Prior to initiating investigation activities field staff will perform a cursory check of all equipment to be used to verify proper function and safe operation. Necessary supplies including field investigation forms and sampling and testing supplies will be restocked as necessary and kept in a clean and secure location between investigations.

4.2 Outfall Investigation

The dry weather outfall screening program is built around the information obtained during outfall investigation activities. Outfall screening and spill reporting are the main methods for discovery of illicit discharges to the MS4. A dry weather investigation consists of verification of the information ACHD has for the outfall and its conveyance as well as qualitative descriptions of the conditions present at the time of the investigation. Investigations also include a review of records from past visits to identify persistent or new conditions.

Upon arrival at the outfall, ACHD personnel will conduct physical observations in the order listed on the Dry Weather Outfall Investigation Form (Form DW1) included in Appendix C. Information to be collected for each outfall includes:

- Location in terms of a description of the nearby streets, receiving water, and other landmarks useful in identifying and locating the outfall.
- Description of major land uses in the outfall drainage area
- The configuration, construction, dimensions, material, and condition of the outfall
- Observations of the outfall and surrounding area including the staining, sedimentation, scour, and condition of vegetation
- Clarity, odor, color, floatables, and intensity of flow, where present
- Presence of trash in or from outfall (reference Form DW2 in Appendix C for trash assessment)
- Photographs of the outfall, surrounding area, flows, if present, and any other features or conditions useful or pertinent to the outfall inventory, screening activities, or reporting

If a discharge is present at the time of investigation, the flow volume will be measured as described in Section 4.3.3. Qualitative characteristics of the flow such as color, odor, and clarity will also be recorded. Sample collection will be scheduled for a later date due to advance notice requirements for the Boise City

Water Quality Laboratory (WQL). Sample collection and flow measurement methods are described in the discharge monitoring section below.

4.3 Discharge Monitoring

To accommodate holding time requirements for E. coli, advance notice is typically required before delivering samples to WQL. As such, discharges are not typically sampled at the time of first discovery. Following Permit requirements monitoring will be performed as described below at the earliest possible date, not to exceed 15 days from the time the new discharge was discovered.

4.3.1 Discharge Parameter Analysis

The analytical methods planned for use in discharge monitoring when flows are present are included in Table 4-1 below. The Permit requires that "sample collection, preservation, and analysis must be conducted according to sufficiently sensitive methods/test procedures approved under 40 Code of Federal Regulations [CFR] Part 136, unless otherwise approved by EPA. Where an approved 40 CFR Part 136 method does not exist, and other test procedures have not been specified, any available method may be used after approval from EPA." As such, the methods identified below are the selected and preferred options. However, sample, laboratory, or instrument conditions may require the substitution of an alternate Part 136 method.

The analytical requirements for dry weather discharge samples are listed in the Permit. Water quality data will be collected using a combination of field parameter measurements using handheld meters, field analysis conducted by field screening staff, and laboratory analysis. Table 4-1 identifies the constituents to be identified, analytical method, and type of analysis.

Table 4-1. Analytical Methods for Dry Weather Discharge Constituents

Constituent	Sample Container	Analytical Method	Holding Time	Sample Analysis Type
pH	500 mL amber glass	EPA 150.1	15 minutes	Field Parameter
Temperature		EPA 170.1		
Turbidity		EPA 180.1		
Dissolved oxygen (DO)		SM 4500 G		
Conductivity		EPA 120.1		
Total chlorine	1 L sterilized plastic	DPD[1]	15 minutes	Field Analytical Test
Total copper		bicinchoninate hydrosulfide reduction	60 minutes	
Total phenols		4-aminoantipyrine	60 minutes	
E. coli	250 mL sterilized plastic	IDEXX Colilert	8 hours	Laboratory Analytical Test
Total suspended solids	4.3 L plastic	SM 2540 D	7 days	
Total phosphorus	500 mL plastic	EPA 200.7	28 days	
Dissolved orthophosphate	250 mL plastic	EPA 200.7	48 hours	
Surfactants (detergents)	1 L plastic	SM 5540 C	48 hours	

[1]*DPD = N,N Diethyl-1,4 Phenylenediamine Sulfate*

4.3.2 Discharge Sample Collection

Samples of discharges documented during investigations will be collected using grab sampling methodologies. Sample collection at each outfall will be accomplished by filling the sample container for each analysis from a point near the center of the flow at the outfall. Depending on outfall configuration, access constraints, and flow volume, the grab samples will be collected using a swing sampler or by hand

and safely positioning the sample bottle in the discharge stream. SOPs for grab sample collection are included in Appendix B. Immediately following sample collection; the field personnel will record the collection date and time for each sample on Form DW1.

Field Analytical Samples

Field analyses including total chlorine, total copper, and total phenols will be conducted using the Hach Stormwater Test Kit. Analysis will be completed within 30 minutes of sample collection. Each analysis will be conducted following the procedures outlined in the Hach Stormwater Test Kit manual. The specific test procedures from the manual have been incorporated into Appendix B. Results of field analyses will be recorded on Form DW1.

Field Parameters

Field parameters including temperature, pH, conductivity, DO, and turbidity will be measured in the field using handheld instruments to avoid changes that may occur between the time when the sample is collected and the time of analysis at the laboratory. Measurements from these field tests will be recorded on Form DW1.

Laboratory Analytical Samples

Samples will be collected for each constituent or suite of constituents in the containers listed in Table 4-1. Preservation techniques in the field are limited to cooling samples to a target sample temperature of less than 6°C, but above freezing. After the samples are collected, sufficient ice will be placed in coolers with the samples to maintain the samples at a maximum temperature of 6°C during transport to WQL.

Chemical preservation measures required for EPA standard methods are accomplished by laboratory personnel after samples are submitted. The EPA standard method for measurement of dissolved orthophosphate requires samples to be filtered within 15 minutes of sample collection. Samples for dissolved orthophosphate will be filtered in the field using a peristaltic pump and laboratory-prepared filters and tubing. Sample filtration will be performed following the procedures outlined in the field filtering SOP in Appendix B.

Chain of Custody Procedures

Standard chain of custody (COC) procedures will be followed for all analytical laboratory samples. COC forms, shown in Appendix C, will be completed prior to submittal of samples to the laboratory. Information recorded on the COC includes the following:

- Name of sampler
- Sample identification (outfall identification number from which the sample was collected)
- Analyses requested
- Sample time
- Sample date

A sample is considered to be “in custody” if it is either in actual physical possession of authorized personnel or in a secured area that is restricted to authorized personnel. Such areas include laboratory refrigerators, the monitoring shed at ACHD, ACHD office space, and ACHD vehicles. All transfers of custody will be recorded by signature, date, and time by both the individual relinquishing custody and the one receiving custody. This information is placed in the designated area on the bottom of standard COC forms.

Samples may be stored for short periods of time in coolers with ice at the ACHD monitoring shed or offices while awaiting submittal to WQL. In these instances, the COC forms will be reviewed and signed by the custody holder listed on the COC form. The COC forms will be kept with the samples at all times.

In most cases, laboratory personnel will be notified with at least one day of notice when samples will be submitted. If samples are submitted to the laboratory during business hours, samples are relinquished to laboratory personnel in person for immediate receipt with signature, date, and time. ACHD has after-hour access to the laboratory to accommodate sample submittal. When sample delivery occurs after hours, samples are placed in a locked refrigerator and the signed COC form is left in the locked laboratory for morning receipt by laboratory personnel.

Sample collection times for QC samples will be recorded as 12:00 on the COC form to maintain duplicates as laboratory blind samples. The actual collection time will be recorded on the field form. The QAPP includes details on the approach to data validation as it pertains to holding times and laboratory qualifiers for QC samples.

4.3.3 Discharge Flow Measurement

Flow measurements will be collected when discharges are present to properly document flows and to aid in pollutant loading estimates. Anticipated flow measurement methodologies include use of a velocity probe in conjunction with pipe dimensions, bucket testing, and visual qualitative assessment. A full description of each flow measurement method is included in the flow measurement section of Appendix B.

For relatively small discharges, a bucket flow test may be used in which a five gallon bucket is placed under the outfall to capture all flow from the outfall for an appropriate duration. This information is then used to calculate flow in cubic feet per second.

For higher flows, the velocity probe is used to obtain an average velocity measurement for the flow. The average velocity is combined with measurements of the area of the flow profile to calculate discharge in cubic feet per second. The SOP includes the measurement and calculation approach for circular pipes, elliptical pipes, and natural or irregular channels.

In situations where flow is present and the outfall is not physically accessible, a qualitative assessment of flow will be recorded and accompanied by a comment stating that the outfall was inaccessible for flow measurement. Qualitative flow assessment will be described using three descriptive categories: trickle, moderate, or substantial. Guidance in the flow measurement section of Appendix B defines each of the qualitative flow measurement terms that will be used and provides guidance for selecting the most appropriate descriptive term.

4.4 Flow Source Tracing

After completing the outfall investigation, discharges from flowing outfalls will be traced to the source of the flow. Finding the source of the discharge often provides important information to help determine whether the discharge is allowable under Permit Part 1.D. Allowable non-stormwater discharges include the following:

- Discharges covered under a separate NPDES permit
- Discharges resulting from a spill or from unusual and severe weather or an emergency
- Discharges consisting of uncontaminated water and not sources of pollution to waters of the U.S.

All documentation collected as part of the evaluation of discharges is required to be included in the Stormwater Management Plan. This includes the documentation and support for the discontinuation of discharge monitoring for outfalls that have allowable discharges.

4.4.1 Flow Source Tracing

Sources will be traced by following drop inlets and manholes upstream of the outfall using field maps showing the drainage system. Smoke testing, dye testing, and closed circuit TV will be used as appropriate to determine the source of the discharge.

Discharge sampling results can often be used to assist in identifying potential sources of pollution. The source tracing flow chart in Appendix D will be used in conjunction with analytical results, field observations, and drainage area analysis to identify likely source(s) of illicit discharges or illegal connections.

4.4.2 Discharge Thresholds

Previously documented flowing outfalls as described in Section 2.2 may be removed from the annual historical flows sampling list if the flow can be characterized as an allowable discharge. Thresholds based on analytical results and receiving waters have been developed to help make this determination. Appendix E includes a description of the thresholds for each monitored constituent of concern and the decision points to be used in evaluating compliance with Permit Part 1.D.

4.5 Escalation and Elimination

If a discharge is found to be illicit based on source tracing and/or chemical analysis, ACHD is required to take appropriate action to address the source of the ongoing discharge within 45 days of detection. To meet this requirement ACHD has established interagency agreements with the City of Boise and Garden City for enforcement of stormwater ordinances in City codes Title 8, Chapter 15 and Title 4, Chapter 14, respectively. Copies of these agreements can be found in the Stormwater Management Plan.

The agreements address enforcement of these ordinances to eliminate illicit discharges and illegal connections and contain escalation measures for application as necessary. ACHD may at any time provide the appropriate jurisdictional authority with evidence of the discharge and the source of flow. Public or private discharges may require action by the city; other discharges may require involvement from the Ada County Sheriff's Office. If the source of the discharge cannot be determined, ACHD will provide available information to assist the jurisdictional authority in eliminating the discharge.

Section 5

Quality Assurance/Quality Control

5.1 QC Sampling Schedule

The QC sampling schedule developed for the dry weather outfall screening program consists of a combination of field QC samples and laboratory QC samples. QC sampling for this program is designed to assess field and laboratory analytical test procedures. QC sample types are fully described in the QAPP. QC sampling intervals will follow the schedule detailed in Table 5-1. Laboratory QC sample results are included in each analytical report.

Table 5-1. Field QC Sample Collection Schedule

QC Sample Method	Sampling Frequency2	Percent of Total Data Represented
Field Duplicate	1 suite per 20 samples	5%
Field Blank	1 suite per 20 samples	5%

[1]QC sample analysis will be performed on laboratory analytical samples only. Analyses conducted by ACHD in the field rely on calibration and accuracy check methods described in Section 3.

[2]Frequency is determined by number of screening program samples collected, regardless of result.

ACHD may choose to conduct additional QA/QC to address data discrepancies, potential sample contamination, or other QA/QC issues. These events will be handled on an as-needed basis, depending on the particular issue(s) involved.

5.2 Data Quality Objectives (DQO)

Field screening efforts will provide data of sufficient quality and quantity in accordance with Permit requirements to detect and eliminate illicit discharges and illegal connections, estimate pollutant concentrations and loading associated with dry weather flows including flows associated with groundwater infiltration and irrigation drainage in the MS4, and support mapping and outfall inventory efforts to maintain accurate records.

Data Quality Indicators (DQIs)

DQIs have been established to set measurable qualitative and quantitative goals for data acceptance that meet the program DQOs described above. Each DQI is described below. DQIs are the basis for addressing field and laboratory analytical instrument performance, as well as sample collection and handling procedures. QA/QC samples provide input for several of the DQIs. QA/QC sample collection procedures are included in Section 2.1 of the QAPP.

DQIs are fully described in Section 1.8.1 of the QAPP. A brief description of each DQI is included in the list below.

- **Project Required Detection Limits (PRDL).** Achieving appropriate reported constituent concentration results at values that allow for comparison to baseline data and water quality standards.

- **Accuracy.** The accuracy of the data is a measure of the extent to which a measured value represents the true value.
- **Precision.** Precision is a measurement of the reproducibility of the analytical data.
- **Bias.** Bias is minimized by using standard data collection and analytical methods and protocols, as well as standard sample preservation, transport, and storage procedures.
- **Representativeness.** Representativeness is a measure of the degree to which data accurately and precisely indicate environmental conditions.
- **Comparability.** The comparability of a data set is the extent to which data accurately and precisely indicate environmental conditions.
- **Completeness.** Completeness is a comparison between the amount of usable data collected versus the total amount of data collected.
- **Sufficiency.** Data set sufficiency is the amount of data required to perform the level or type of analysis necessary for each monitoring element.

Analysis-specific data quality indicators include PRDLs and precision evaluated as relative percent difference (RPD). The target values for these indicators are listed in Table 5-2 below.

Table 5-2. Data Quality Indicator Targets

Constituent	Analytical Method	PRDL[1,2]	Units	Precision[3,4] (RPD)
Temperature	EPA 170.1	0.01	°C	NA
pH	EPA 150.1	0.01	S.U.	NA
Dissolved oxygen	SM 4500 G	0.01	mg/L	NA
Conductivity	EPA 120.1	0.1	µS/cm	NA
Turbidity	EPA 180.1	0.1	NTU	20%
Total chlorine	DPD[5]	0.1	mg/L	NA
Total copper	bicinchninate hydrosulfide reduction	0.1	mg/L	NA
Total phenols	4-aminoantipyrine	0.1	mg/L	NA
Total phosphorus	EPA 200.7	0.04	mg/L	20%
Dissolved orthophosphate	EPA 365.1 or SM 4500-P E	0.084	mg/L	20%
E. coli[6]	IDEXX Colilert	1.8	MPN/100 mL	20%
Total suspended solids	SM 2540 D	1.0	mg/L	20%
Surfactants (detergents)	SM 5540C	0.014	mg/L	20%

[1]*Field instrument resolution values are listed in lieu of a PRDL for field parameter measurements.*

[2]*PRDL is defined as the effective method detection limit (MDL) as reported by the analytical laboratory.*

[3]*Precision calculations based on field duplicate samples.*

[4]*In cases where one value is reported at the MDL and the other value is less than five times the MDL, the samples will be considered within acceptable precision limits.*

[5]*N,N Diethyl-1,4 Phenylenediamine Sulfate*

[6]*Assessment of precision for E. coli is evaluated using the RPD of logarithmic parent and duplicate values.*

Section 6

Data Management and Reporting

6.1 Data Acquisition Requirements (Non-Direct Measurements)

Weather forecasts and hourly precipitation totals will typically be obtained from the NWS Boise airport station website and used for confirmation of antecedent dry periods. Additional forecasts or weather reports may be obtained from local media, community, or commercial weather services, ACHD and Permittee-owned rain gauges.

6.2 Data Management System

Data associated with the dry weather outfall screening program will be stored in the Microsoft Access Outfall Database on the secure ACHD network at V:\9DrainageDivision\VanPattenAdam\Outfalls.adp. Data stored in the Outfall Database includes the following elements:

- Time since most recent precipitation event greater than 0.1 inches of rain
- Quantity of most recent rain event greater than 0.1 inches of rain
- Site description (conveyance type, dominant watershed land uses)
- Flow estimation (width of water surface, depth of water, approximate flow velocity, approximate flow rate)
- Visual qualitative observations (odor, color, clarity, floatables, deposits/staining, biology, condition of vegetation, structural condition of outfall, qualitative flow)
- Sample analytical results
- QA/QC results
- Narrative description of flow tracing, determination of discharge authorization (allowable or illicit), and documentation of any corrective measures including stopping the discharge, disconnecting illegal connections or other enforcement and escalation activities

6.3 Data Organization and Reporting

6.3.1 Investigation Results Organization

Upon returning to the office, data that has been collected in the field will be filed according to data type.

- Photographs taken will be downloaded and stored in a word document photo log for the event. The photo log will include the date and outfall number and will be filed under the outfall file on the secure ACHD server at V:\92OutfallPictures\OutfallPhotos. A link to the photo log will be included in the Access database for each investigation. Each picture will include a caption with a description of the subject and location of the picture as well as the vantage point.
- GPS data will be checked against existing data for outfall locations and corrected in GIS as necessary.
  - Coordinates of new outfalls encountered will be entered into the outfalls layer in GIS and subsequently researched to determine drainage area and incorporated into the outfall inventory.
  - In the event that the outfall to be investigated no longer exists, the outfall as an attribute will be reassigned to a separate shapefile and removed from the outfall inventory. Records of the outfall

will be retained for at least five years or the duration of the Permit. Records may be retained longer at the discretion of ACHD.

- Newly identified outfalls will be numbered according to the township, range, and section in which the outfall occurs. Outfalls located in the same section are numbered sequentially beginning with 001. Additionally, an individual file will be created in the Access database and on the server.
- Field data sheets and photographs will be scanned and filed under the corresponding reporting year on the server, and the hardcopies will be stored in the corresponding hardcopy file. Data from the field sheets will be entered in to Access intermittently throughout the year. ACHD is currently in the process of researching electronic field form options to replace the use of hardcopy field data sheets.

6.3.2 Annual Reporting

The annual report will include an updated map of ACHD-owned outfalls as well as any changes in water body designations. The map will include all reported and documented illicit discharges and illegal connections. The map will be made available as an electronic map file and a pdf.

The annual report will also contain an evaluation of compliance for the illicit discharge detection and elimination program. That evaluation will include a summary of the activities and progress of the dry weather outfall screening program. The total number of outfalls screened, including a count of outfalls discharging to impaired waters (at least 20 percent required), the number of flowing outfalls screened, and the number of outfalls screened between June 1 and September 30 (at least one third required).

Discharge Monitoring Results

Results of samples collected from monitored discharges will be summarized with each annual report. Discharge monitoring results will be used to evaluate flows associated with irrigation and groundwater seepage to determine whether the flows comply with Permit Part 1.D. Flows that are found to be in compliance with Permit Part 1.D (flows that are not sources of pollution to waters of the US) will be identified in the annual report and removed from the annual flow screening schedule for subsequent years. The rationale for removing these flows from annual screening schedules will also be recorded in the stormwater management plan.

Pollutant Loading Estimates

Discharge monitoring results will be used in conjunction with flow measurements to calculate pollutant loading estimates associated with the observed flows. Estimates of the duration of the year that flows were present at each outfall will be provided with the pollutant loading estimates when available. The duration of each flow during the year will be refined as more data is collected each year. Pollutant loading estimates will also be used to prioritize flows for evaluation of feasible actions necessary to eliminate flows that are not in compliance with Permit Part 1.D.

6.3.3 Evaluation and Assessment

Evaluation and assessment of the dry weather outfall screening data and the overall effectiveness of the Dry Weather Outfall Screening Program will be conducted in compliance with the general guidance identified in the PMEP. For the Dry Weather Outfall Screening Program, data will be compiled with the objective to eliminate illicit discharges and illegal connections to the MS4 and to evaluate the effectiveness of stormwater management efforts at reducing pollutant loads from the MS4.

Advancing illicit discharge detection and elimination is an iterative process. The dry weather outfall screening program will be annually evaluated for compliance with Permit requirements. Evaluation efforts will also assess how well the dry weather outfall screening program aligns with the Level of Service goals outlined in the ACHD Phase I Stormwater management plan. Changes and revisions to the program including

updated methods or revised approaches will be integrated into the program as updates to this Dry Weather Outfall Screening Plan and/or the SOPs referenced herein.

Section 7

References

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———, Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8), EPA 240-R-02-004, Office of Environmental Information, 2002.

———, Guidance on Systematic Planning Using the Data Quality Objective Process, EPA Bulletin # EPA 240-B-06-001, 2006.

———, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, Analysis and Sampling Procedures; Final Rule, Federal Register Vol. 77 No. 97. 40 CFR Parts 136, 260, et al., 2012.

Figures



FIG-1

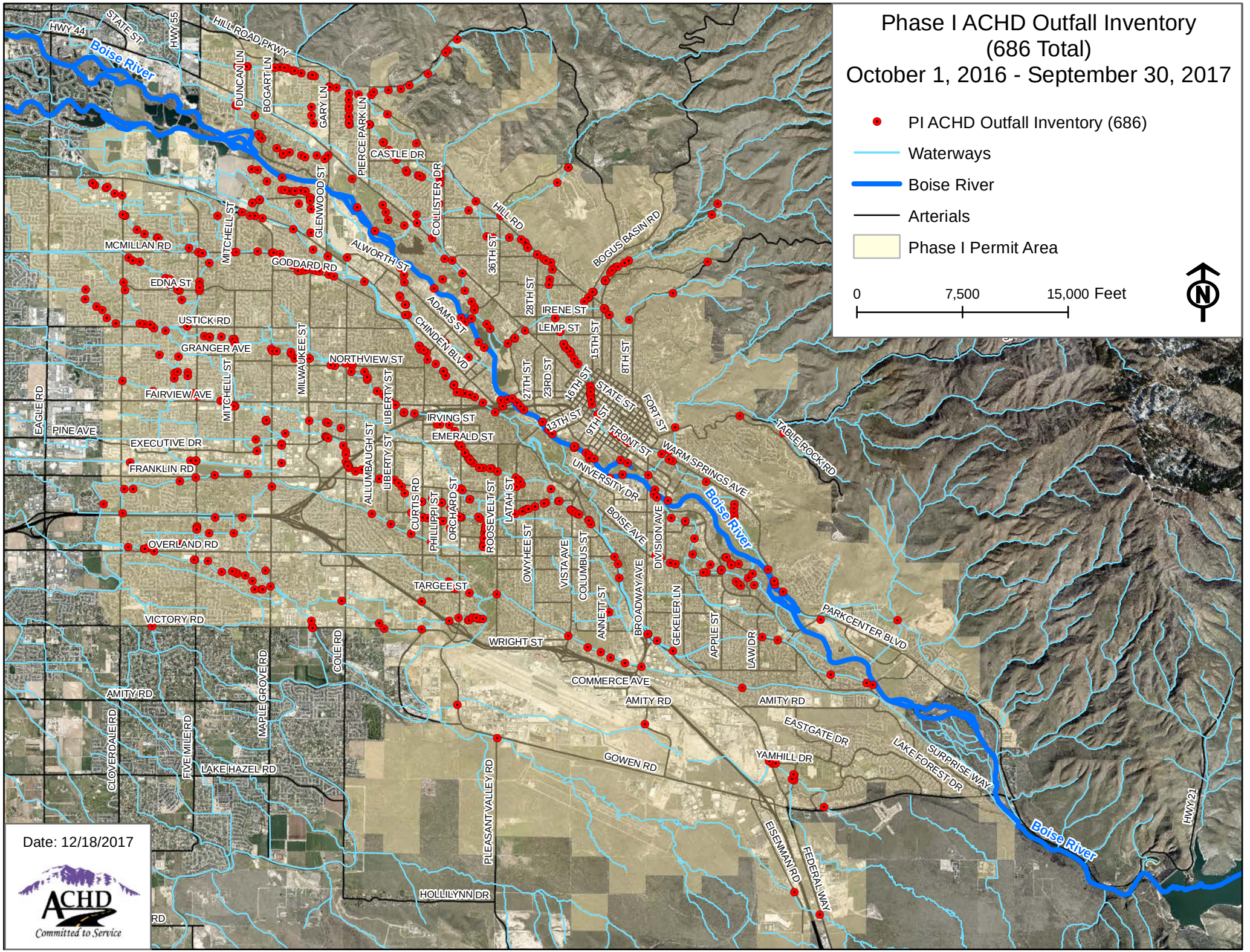
Phase I ACHD Outfall Inventory
(686 Total)
October 1, 2016 - September 30, 2017
PI ACHD Outfall Inventory (686)
Waterways
Boise River
Arterials
Phase I Permit Area
0
7,500
15,000 Feet
N
Boise River
HWY 44
STATE ST
HWY 55
HILL ROAD PKWY
DUNCAN LN
BOGART LN
GARY LN
PIERCE PARK LN
CASTLE DR
COLLISTER DR
HILL RD
BOGUS BASIN RD
GLENWOOD ST
MITCHELL ST
MCMILLAN RD
GODDARD RD
ALWORTH ST
ADAMS ST
CHINDEN BLVD
36TH ST
28TH ST
IRENE ST
LEMP ST
15TH ST
8TH ST
EDNA ST
USTICK RD
GRANGER AVE
NORTHVIEW ST
MILWAUKEE ST
LIBERTY ST
27TH ST
23RD ST
16TH ST
13TH ST
9TH ST
STATE ST
FORT ST
FRONT ST
WARM SPRINGS AVE
TABLE ROCK RD
EAGLE RD
PINE AVE
FAIRVIEW AVE
EXECUTIVE DR
FRANKLIN RD
IRVING ST
EMERALD ST
ALLUMBAUGH ST
CURTIS RD
PHILLIPPI ST
ORCHARD ST
ROOSEVELT ST
LATAH ST
UNIVERSITY DR
BOISE AVE
DIVISION AVE
OWYHEE ST
VISTA AVE
COLUMBUS ST
ANNETT ST
BROADWAY AVE
GEKELER LN
APPLE ST
LAW DR
PARKCENTER BLVD
OVERLAND RD
TARGEE ST
VICTORY RD
WRIGHT ST
COLE RD
COMMERCE AVE
AMITY RD
MAPLE GROVE RD
CLOVERDALE RD
FIVE MILE RD
LAKE HAZEL RD
PLEASANT VALLEY RD
GOWEN RD
EASTGATE DR
YAMHILL DR
LAKE FOREST DR
SURPRISE WAY
EISENMAN RD
FEDERAL WAY
HWY 21
HOLLILYNN DR
Date: 12/18/2017
ACHD
Committed to Service

FIG-2

Tables

Table 2-1	
Receiving Water Body	Number of Outfalls
Ash Lateral	2
Bennett Lateral	1
Boise City Canal	58
Boise City Canal-drain of	0
Boise River	36
Boise River-Trib to	1
Boise Valley Canal	3
Bubb Canal	6
Chaffin Drain	1
Cloverdale Lateral	1
Collis Lateral	3
Cottonwood Creek	3
Cottonwood Creek-Trib of	2
Crane Creek	24
Davis Drain	26
Drain A	0
Drain B	0
Drain E	0
Dry Creek	2
Dry Creek Canal	6
Eagle Drain	46
Eagle Drain-lateral of	3
Eggers Lateral	1
Eightmile Creek	1
Elmore Drain	12
Eureka Canal	0
Farmer's Lateral	15
Farmer's Union Canal	12
Fitz Lateral	1
Fivemile Creek	30
Fivemile Creek-Trib. to	8
Gruber Lateral	1
Helm Lateral	1
Hulls Gulch	7
Hulls Gulch-Lateral of	1
Huntington Lateral	5
Julia Davis Pond	2
Karnes Lateral	11
Lake Elmore	1
Lake Heron	1
Lake Heron Creek-north fork	0
Lake Heron Creek-south fork	1
Lake Heron-lateral of	1
Logger Creek	13
Logger Creek-Lateral	1

Table 2-1 cont.	
Receiving Water Body	**Number of Outfalls**
Lowell Drain	1
McMillan Lateral	7
Milk Lateral	5
New York Canal	8
North Slough	74
Penitentiary Canal	1
Penninger Lateral	2
Penninger Secondary	1
Pierce Creek	7
Pierce Gulch	1
Powell Lateral	4
Ridenbaugh Canal	75
Ridenbaugh Ditch	7
Rust Lateral	4
Settler's Canal	33
Settler's Canal Lateral	6
Shavrer Lateral	2
South Slough	16
Stewart Gulch	6
Synder Lateral	2
Threemile Creek	7
Threemile Lateral	9
Thurman Mill Canal	17
Thurman Mill Canal-Lateral	4
Tuttle Lateral	1
Warm Springs Canal	18
Watson Drain	2
Watson Drain-Lateral	1
Wilson Fruit Lateral	2
Zinger Lateral	13
Total	**686**

Table 2-2 Clean Water Act §303 (d) listed Water Bodies and Pollutants of Concern		
Receiving Water Body	Assessment Unit Code	Pollutants of Concern Causing Impairments
Boise River – Diversion Dam to River Mile 50	ID17050114SW011a_06	Temperature
Boise River – River Mile 50 to Star Bridge	ID1705011SW005_06	Temperature, Sediment, E. coli
Boise River – Star to Middleton	ID17050114SW005_06a	Temperature, Total Phosphorus, Sediment
Boise River – Middleton to Indian Creek	ID17050114SW005_06b	Temperature, Total Phosphorus, Sediment (TSS), E. coli
Boise River – Indian Creek to the mouth	ID17050114SW001_06	Temperature, Total Phosphorus, Sediment
Tenmile Creek – 3rd order below Blacks Creek Reservoir	ID17050114SW008_03	Sediment (TSS), E. coli
Fivemile Creek – 1st & 2nd order tributaries	ID17050114SW010_02	E. coli
Fivemile Creek – 3rd order tributaries	ID1705114SW010_03	Sediment (TSS), E.Coli

Appendix A: Five-Year Outfall Screening Schedule

Outfall Screening Schedule 2017-2018

#	Outfall ID	Ownership	Receiving Water
1	2n3e06_001	ACHD	Fivemile Creek
2	3n1e01_001	ACHD	North Slough
3	3n1e01_003	ACHD	North Slough
4	3n1e01_013	ACHD	North Slough
5	3n1e02_001	ACHD	North Slough
6	3n1e03_001	ACHD	North Slough
7	3n1e03_007	ACHD	Milk Lateral
8	3n1e03_008	ACHD	Milk Lateral
9	3n1e03_009	ACHD	Milk Lateral
10	3n1e03_016	ACHD	Milk Lateral
11	3n1e12_005	ACHD	South Slough
12	3n1e12_009	ACHD, Railroad	South Slough
13	3n1e12_021	ACHD	Ridenbaugh Canal
14	3n1e12_028	ACHD	Ridenbaugh Canal
15	3n1e13_002	ACHD	Farmer's Lateral
16	3n1e14_006	ACHD	Wilson Fruit Lateral
17	3n1e14_007	ACHD	Unnamed Ditch
18	3n1e15_008	ACHD	Ridenbaugh Canal
19	3n1e23_004	ACHD	Fivemile Creek
20	3n2e03_006	ACHD	Boise City Canal
21	3n2e04_018	ACHD	Boise City Canal
22	3n2e04_022	ACHD	Boise City Canal
23	3n2e05_017	ACHD, Private	Davis Drain
24	3n2e05_018	ACHD, Private	Davis Drain
25	3n2e05_025	ACHD	Thurman Mill Canal
26	3n2e06_001	ACHD	North Slough
27	3n2e06_011	ACHD	Davis Drain
28	3n2e06_015	ACHD	North Slough
29	3n2e07_006	ACHD	Ridenbaugh Canal
30	3n2e07_013	ACHD	Ridenbaugh Canal
31	3n2e07_014	ACHD	Ridenbaugh Canal
32	3n2e07_016	ACHD	North Slough
33	3n2e07_021	ACHD	Ridenbaugh Canal
34	3n2e08_007	ACHD, Private	North Slough
35	3n2e08_011	ACHD	North Slough
36	3n2e08_014	ACHD	North Slough
37	3n2e08_015	ACHD	North Slough
38	3n2e08_019	ACHD, Private	Settler's Canal
39	3n2e08_020	ACHD	North Slough
40	3n2e08_026	ACHD, Private	North Slough
41	3n2e08_033	ACHD	North Slough
42	3n2e09_014	ACHD	North Slough
43	3n2e09_015	ACHD	North Slough
44	3n2e09_022	ACHD, ITD	Boise River
45	3n2e10_005	ACHD	Boise City Canal
46	3n2e10_006	ACHD	Boise City Canal
47	3n2e10_018	ACHD	Boise River
48	3n2e10_019	ACHD, Private	Boise River
49	3n2e10_020	ACHD	Boise River
50	3n2e10_022	ACHD	Boise River
51	3n2e10_031	ACHD, BSU	Boise River
52	3n2e10_043	ACHD	Boise City Canal
53	3n2e11_007	ACHD	Cottonwood Creek
54	3n2e11_008	ACHD	Cottonwood Creek
55	3n2e12_001	ACHD	Cottonwood Creek-Trib of
56	3n2e13_003	ACHD	Boise City Canal
57	3n2e14_003	ACHD	Logger Creek
58	3n2e14_016	ACHD	Boise River
59	3n2e14_017	ACHD, ITD	Boise River
60	3n2e14_027	ACHD, Boise City	Logger Creek
61	3n2e15_007	ACHD	Ridenbaugh Canal
62	3n2e16_002	ACHD	North Slough

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2017-2018 cont.

#	Outfall ID	Ownership	Receiving Water
63	3n2e16_003	ACHD	Powell Lateral
64	3n2e16_016	ACHD	Ridenbaugh Canal
65	3n2e16_018	ACHD, Irrigation	Ridenbaugh Canal
66	3n2e16_019	ACHD	Ridenbaugh Canal
67	3n2e17_004	ACHD	Ridenbaugh Canal
68	3n2e17_013	ACHD	Rust Lateral
69	3n2e17_014	ACHD	Powell Lateral
70	3n2e17_016	ACHD, Irrigation	Ridenbaugh Canal
71	3n2e17_017	ACHD	Farmer's Lateral
72	3n2e17_019	ACHD	Farmer's Lateral
73	3n2e17_022	ACHD	Farmer's Lateral
74	3n2e17_040	ACHD	Ridenbaugh Ditch
75	3n2e18_017	ACHD	Ridenbaugh Canal
76	3n2e19_002	ACHD	Threemile Lateral
77	3n2e19_003	ACHD	Threemile Creek
78	3n2e20_004	ACHD	Penninger Lateral
79	3n2e20_008	ACHD	Threemile Lateral
80	3n2e20_012	ACHD	Threemile Lateral
81	3n2e20_019	ACHD	Threemile Creek
82	3n2e22_002	ACHD	Ridenbaugh Canal
83	3n2e24_005	ACHD	Boise River
84	3n2e24_019	ACHD	Logger Creek-Lateral
85	3n2e36_001	ACHD	Fivemile Creek-Trib. to
86	4n1e13_006	ACHD	Eagle Drain
87	4n1e13_007	ACHD	Eagle Drain
88	4n1e13_012	ACHD	Eagle Drain
89	4n1e13_015	ACHD	Eagle Drain
90	4n1e14_005	ACHD	Eagle Drain
91	4n1e14_006	ACHD	Eagle Drain
92	4n1e14_010	ACHD	Eagle Drain
93	4n1e23_007	ACHD	Warm Springs Canal

#	Outfall ID	Ownership	Receiving Water
94	4n1e23_014	ACHD	Dry Creek Canal
95	4n1e24_003	ACHD	Eagle Drain-lateral of
96	4n1e24_022	ACHD, ITD	Dry Creek Canal
97	4n1e25_021	ACHD, ITD	Thurman Mill Canal
98	4n1e25_029	ACHD	Warm Springs Canal
99	4n1e25_032	ACHD	Settler's Canal
100	4n1e26_007	ACHD	Settler's Canal
101	4n1e26_012	ACHD	Thurman Mill Canal-Lateral
102	4n1e27_002	ACHD	Zinger Lateral
103	4n1e27_008	ACHD	Zinger Lateral
104	4n1e27_009	ACHD	Zinger Lateral
105	4n1e28_004	ACHD	McMillan Lateral
106	4n1e28_006	ACHD	McMillan Lateral
107	4n1e32_001	ACHD	North Slough
108	4n1e34_002	ACHD	Karnes Lateral
109	4n1e34_004	ACHD, Irrigation	Karnes Lateral
110	4n1e34_008	ACHD	Karnes Lateral
111	4n1e34_010	ACHD	Karnes Lateral
112	4n1e35_001	ACHD	Zinger Lateral
113	4n1e35_006	ACHD	Settler's Canal
114	4n1e36_003	ACHD	Settler's Canal
115	4n1e36_011	ACHD	Settler's Canal
116	4n2e17_003	ACHD	Pierce Gulch
117	4n2e18_001	ACHD	Farmer's Union Canal
118	4n2e18_002	ACHD	Pierce Creek
119	4n2e18_004	ACHD	Pierce Creek
120	4n2e18_008	ACHD	Eagle Drain
121	4n2e19_001	ACHD	Eagle Drain
122	4n2e19_010	ACHD	Eagle Drain
123	4n2e19_011	ACHD	Eagle Drain
124	4n2e19_016	ACHD	Eagle Drain

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2017-2018 cont.

#	Outfall ID	Ownership	Receiving Water
125	4n2e19_029	ACHD	Eagle Drain
126	4n2e21_002	ACHD	Stewart Gulch
127	4n2e28_001	ACHD	Boise City Canal
128	4n2e28_002	ACHD	Boise City Canal
129	4n2e28_008	ACHD	Boise City Canal
130	4n2e30_004	ACHD	Dry Creek Canal
131	4n2e30_012	ACHD	Boise River
132	4n2e32_002	ACHD, Private	Boise River
133	4n2e32_012	ACHD	Farmer's Union Canal
134	4n2e32_014	ACHD	Farmer's Union Canal
135	4n2e32_016	ACHD	Farmer's Union Canal
136	4n2e33_001	ACHD	Boise City Canal
137	4n2e33_006	ACHD	Crane Creek
138	4n2e33_007	ACHD	Boise City Canal
139	4n2e34_007	ACHD	Crane Creek
140	4n2e35_004	ACHD	Hulls Gulch-Lateral of

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2018-2019

#	Outfall ID	Ownership	Receiving Water
1	3n1e01_004	ACHD	North Slough
2	3n1e01_007	ACHD	North Slough
3	3n1e01_008	ACHD	North Slough
4	3n1e02_009	ACHD	North Slough
5	3n1e02_010	ACHD	Milk Lateral
6	3n1e10_006	ACHD	Settler's Canal Lateral
7	3n1e11_012	ACHD	South Slough
8	3n1e12_029	ACHD	Ridenbaugh Canal
9	3n1e14_008	ACHD	Huntington Lateral
10	3n1e14_011	ACHD	Huntington Lateral
11	3n1e15_002	ACHD	Fivemile Creek
12	3n1e15_003	ACHD	Fivemile Creek
13	3n1e15_011	ACHD	Synder Lateral
14	3n1e15_012	ACHD	Ridenbaugh Canal
15	3n1e23_003	ACHD	Fivemile Creek
16	3n1e23_006	ACHD	Fivemile Creek
17	3n1e23_009	ACHD	Fivemile Creek
18	3n1e24_001	ACHD	Threemile Creek
19	3n1e24_002	ACHD	Fivemile Creek
20	3n1e24_004	ACHD	Fivemile Creek
21	3n2e03_009	ACHD	Boise City Canal
22	3n2e03_010	ACHD	Boise City Canal
23	3n2e04_009	ACHD	Boise River
24	3n2e04_011	ACHD, ITD	Boise River
25	3n2e04_013	ACHD	Boise City Canal
26	3n2e04_019	ACHD	Boise City Canal
27	3n2e04_027	ACHD	Crane Creek
28	3n2e05_006	ACHD	Thurman Mill Canal
29	3n2e05_008	ACHD	Settler's Canal
30	3n2e05_014	ACHD, ITD	Davis Drain
31	3n2e05_023	ACHD	Davis Drain

#	Outfall ID	Ownership	Receiving Water
32	3n2e05_024	ACHD	Boise River
33	3n2e06_009	ACHD	Davis Drain
34	3n2e06_012	ACHD	North Slough
35	3n2e06_016	ACHD	North Slough
36	3n2e06_017	ACHD	North Slough
37	3n2e08_001	ACHD, Private	North Slough
38	3n2e08_004	ACHD	North Slough
39	3n2e08_013	ACHD	North Slough
40	3n2e08_031	ACHD	North Slough
41	3n2e10_004	ACHD	Boise City Canal
42	3n2e10_007	ACHD	Boise City Canal
43	3n2e10_011	ACHD	Julia Davis Pond
44	3n2e10_037	ACHD	Boise City Canal
45	3n2e10_045	ACHD	Boise City Canal
46	3n2e10_046	ACHD, Private	Boise River
47	3n2e11_005	ACHD	Boise City Canal
48	3n2e12_005	ACHD	Cottonwood Creek-Trib of
49	3n2e13_002	ACHD	Lake Heron
50	3n2e13_004	ACHD	Boise City Canal
51	3n2e13_008	ACHD	Logger Creek
52	3n2e15_006	ACHD	Ridenbaugh Canal
53	3n2e15_008	ACHD	Ridenbaugh Canal
54	3n2e16_011	ACHD	Ridenbaugh Canal
55	3n2e16_014	ACHD	Powell Lateral
56	3n2e16_021	ACHD	Ridenbaugh Canal
57	3n2e17_005	ACHD	Ridenbaugh Canal
58	3n2e17_008	ACHD	Farmer's Lateral
59	3n2e17_012	ACHD, Irrigation	Rust Lateral
60	3n2e17_020	ACHD	Farmer's Lateral
61	3n2e17_023	ACHD	Farmer's Lateral
62	3n2e17_038	ACHD	Ridenbaugh Ditch

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2018-2019 cont.

#	Outfall ID	Ownership	Receiving Water
63	3n2e17_041	ACHD	Ridenbaugh Ditch
64	3n2e18_001	ACHD, Railroad	Ridenbaugh Canal
65	3n2e18_003	ACHD	Ridenbaugh Canal
66	3n2e18_005	ACHD	Ridenbaugh Canal
67	3n2e18_010	ACHD	Ridenbaugh Canal
68	3n2e18_013	ACHD	Farmer's Lateral
69	3n2e18_014	ACHD	Farmer's Lateral
70	3n2e18_018	ACHD	Ridenbaugh Ditch
71	3n2e20_002	ACHD	Penninger Lateral
72	3n2e20_013	ACHD	Threemile Lateral
73	3n2e20_014	ACHD	Threemile Lateral
74	3n2e20_015	ACHD	Threemile Lateral
75	3n2e20_016	ACHD	Penninger Secondary
76	3n2e20_018	ACHD	New York Canal
77	3n2e24_023	ACHD	Lake Heron Creek-south fork
78	3n2e24_024	ACHD	Logger Creek
79	3n2e26_003	ACHD	Ridenbaugh Canal
80	3n2e26_006	ACHD	Ridenbaugh Canal
81	3n2e28_002	ACHD	New York Canal
82	3n3e19_001	ACHD	Boise River-Trib to
83	3n3e30_005	ACHD	Ridenbaugh Canal
84	3n3e30_006	ACHD	Ridenbaugh Canal
85	4n1e13_002	ACHD	Eagle Drain
86	4n1e13_010	ACHD	Eagle Drain
87	4n1e13_017	ACHD	Eagle Drain
88	4n1e14_011	ACHD	Eagle Drain
89	4n1e23_004	ACHD	Elmore Drain
90	4n1e23_008	ACHD	Warm Springs Canal
91	4n1e23_009	ACHD	Dry Creek
92	4n1e24_021	ACHD	Elmore Drain
93	4n1e24_024	ACHD	Elmore Drain

#	Outfall ID	Ownership	Receiving Water
94	4n1e25_004	ACHD	Warm Springs Canal
95	4n1e25_005	ACHD	Warm Springs Canal
96	4n1e25_008	ACHD	Warm Springs Canal
97	4n1e25_013	ACHD	Warm Springs Canal
98	4n1e25_015	ACHD, ITD	Warm Springs Canal
99	4n1e25_019	ACHD	Thurman Mill Canal
100	4n1e25_022	ACHD, ITD	Thurman Mill Canal
101	4n1e26_001	ACHD	Thurman Mill Canal
102	4n1e26_011	ACHD	Thurman Mill Canal-Lateral
103	4n1e26_015	ACHD	Thurman Mill Canal
104	4n1e26_021	ACHD	Settler's Canal
105	4n1e26_030	ACHD	Settler's Canal
106	4n1e27_003	ACHD	Zinger Lateral
107	4n1e27_005	ACHD	Zinger Lateral
108	4n1e27_007	ACHD	Zinger Lateral
109	4n1e28_003	ACHD	McMillan Lateral
110	4n1e34_015	ACHD	North Slough
111	4n1e34_016	ACHD	North Slough
112	4n1e34_017	ACHD	North Slough
113	4n1e34_020	ACHD	Settler's Canal
114	4n1e34_024	ACHD	Karnes Lateral
115	4n1e35_008	ACHD	Zinger Lateral
116	4n1e36_014	ACHD	Settler's Canal
117	4n1e36_031	ACHD	Thurman Mill Canal
118	4n2e17_002	ACHD	Pierce Creek
119	4n2e18_009	ACHD	Eagle Drain
120	4n2e19_002	ACHD	Eagle Drain
121	4n2e19_008	ACHD	Lake Elmore
122	4n2e19_022	ACHD	Farmer's Union Canal
123	4n2e20_002	ACHD	Boise City Canal
124	4n2e26_004	ACHD	Crane Creek

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2018-2019 cont.

#	Outfall ID	Ownership	Receiving Water
125	4n2e26_007	ACHD	Crane Creek
126	4n2e28_007	ACHD	Boise City Canal
127	4n2e29_003	ACHD	Stewart Gulch
128	4n2e30_013	ACHD	Dry Creek Canal
129	4n2e31_004	ACHD	Davis Drain
130	4n2e31_007	ACHD	Davis Drain
131	4n2e31_016	ACHD	Davis Drain
132	4n2e32_006	ACHD	Boise River
133	4n2e32_015	ACHD	Boise River
134	4n2e33_004	ACHD	Boise City Canal
135	4n2e33_009	ACHD	Boise City Canal
136	4n2e34_012	ACHD	Crane Creek
137	4n2e34_015	ACHD	Crane Creek
138	4n2e34_017	ACHD	Crane Creek
139	4n2e34_022	ACHD	Hulls Gulch
140	4n2e34_026	ACHD	Hulls Gulch

Outfall Screening Schedule 2019-2020

#	Outfall ID	Ownership	Receiving Water
1	3n1e01_010	ACHD	North Slough
2	3n1e01_012	ACHD	North Slough
3	3n1e01_014	ACHD	North Slough
4	3n1e01_015	ACHD	Eggers Lateral
5	3n1e02_003	ACHD	North Slough
6	3n1e02_004	ACHD	North Slough
7	3n1e02_008	ACHD	South Slough
8	3n1e02_013	ACHD	North Slough
9	3n1e03_010	ACHD	Settler's Canal
10	3n1e03_012	ACHD	South Slough
11	3n1e03_015	ACHD	Settler's Canal
12	3n1e10_003	ACHD	Settler's Canal Lateral
13	3n1e11_002	ACHD	Chaffin Drain
14	3n1e11_011	ACHD	Collis Lateral
15	3n1e12_013	ACHD	South Slough
16	3n1e15_004	ACHD	Fivemile Creek
17	3n1e16_003	ACHD	Synder Lateral
18	3n1e22_001	ACHD	Fivemile Creek
19	3n1e22_002	ACHD	Fivemile Creek
20	3n1e23_005	ACHD	Farmer's Lateral
21	3n1e23_012	ACHD	Fivemile Creek
22	3n1e23_014	ACHD	Fivemile Creek
23	3n1e24_003	ACHD	Fivemile Creek
24	3n2e03_008	ACHD	Boise City Canal
25	3n2e03_013	ACHD	Boise City Canal
26	3n2e04_001	ACHD	Settler's Canal Lateral
27	3n2e04_014	ACHD, ITD	Settler's Canal Lateral
28	3n2e05_002	ACHD, Irrigation	Settler's Canal
29	3n2e05_009	ACHD, Private	Davis Drain
30	3n2e05_010	ACHD, Private	Davis Drain
31	3n2e05_019	ACHD	Davis Drain

#	Outfall ID	Ownership	Receiving Water
32	3n2e05_041	ACHD	Thurman Mill Canal
33	3n2e06_002	ACHD	North Slough
34	3n2e06_003	ACHD	Ash Lateral
35	3n2e06_014	ACHD	North Slough
36	3n2e06_019	ACHD	Davis Drain
37	3n2e06_020	ACHD	Davis Drain
38	3n2e07_005	ACHD	North Slough
39	3n2e07_009	ACHD, Railroad	Ridenbaugh Canal
40	3n2e07_020	ACHD	North Slough
41	3n2e08_008	ACHD, Private	North Slough
42	3n2e08_010	ACHD, Private	North Slough
43	3n2e08_012	ACHD	North Slough
44	3n2e08_028	ACHD	North Slough
45	3n2e08_029	ACHD, Private	Tuttle Lateral
46	3n2e09_024	ACHD	Boise River
47	3n2e10_008	ACHD	Boise City Canal
48	3n2e10_023	ACHD, Boise City	Boise River
49	3n2e10_024	ACHD	Boise River
50	3n2e10_042	ACHD	Boise City Canal
51	3n2e11_001	ACHD	Boise City Canal
52	3n2e11_004	ACHD	Boise City Canal
53	3n2e11_009	ACHD, Boise City	Cottonwood Creek
54	3n2e12_004	ACHD	Cottonwood Creek-Trib of
55	3n2e13_006	ACHD	Boise City Canal
56	3n2e14_028	ACHD	Bubb Canal
57	3n2e15_009	ACHD	Ridenbaugh Canal
58	3n2e15_023	ACHD	Ridenbaugh Canal
59	3n2e15_024	ACHD	Ridenbaugh Canal
60	3n2e16_005	ACHD	Ridenbaugh Canal
61	3n2e16_007	ACHD, Irrigation	Ridenbaugh Canal
62	3n2e16_008	ACHD	Ridenbaugh Canal

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2019-2020 cont.

#	Outfall ID	Ownership	Receiving Water
63	3n2e16_009	ACHD	Ridenbaugh Canal
64	3n2e16_022	ACHD	Ridenbaugh Canal
65	3n2e16_023	ACHD	Ridenbaugh Canal
66	3n2e17_018	ACHD	Farmer's Lateral
67	3n2e17_021	ACHD, Private	Farmer's Lateral
68	3n2e17_025	ACHD	Farmer's Lateral
69	3n2e17_034	ACHD, Private	Ridenbaugh Canal
70	3n2e18_009	ACHD, Irrigation	Ridenbaugh Canal
71	3n2e20_006	ACHD	Threemile Creek
72	3n2e22_014	ACHD	Bennett Lateral
73	3n2e23_013	ACHD	Bubb Canal
74	3n2e23_016	ACHD, Private	Unnamed Ditch
75	3n2e24_004	ACHD	Boise City Canal
76	3n2e24_030	ACHD	Watson Drain
77	3n2e24_041	ACHD	Boise River
78	3n2e25_001	ACHD	Ridenbaugh Canal
79	3n2e26_004	ACHD, ITD	Ridenbaugh Canal
80	3n2e27_003	ACHD	New York Canal
81	3n2e36_003	ACHD	Fivemile Creek-Trib. to
82	3n2e36_006	ACHD	Fivemile Creek-Trib. to
83	3n2e36_007	ACHD	Fivemile Creek-Trib. to
84	4n1e13_008	ACHD	Eagle Drain
85	4n1e13_016	ACHD	Eagle Drain
86	4n1e14_013	ACHD	Eagle Drain
87	4n1e23_005	ACHD	Elmore Drain
88	4n1e24_004	ACHD	Elmore Drain
89	4n1e25_010	ACHD	Warm Springs Canal
90	4n1e25_011	ACHD, Private	Warm Springs Canal
91	4n1e25_030	ACHD	Warm Springs Canal
92	4n1e25_034	ACHD	Warm Springs Canal
93	4n1e25_037	ACHD	Warm Spring Canal

#	Outfall ID	Ownership	Receiving Water
94	4n1e26_005	ACHD	Settler's Canal
95	4n1e26_014	ACHD	Thurman Mill Canal-Lateral
96	4n1e26_017	ACHD	Helm Lateral
97	4n1e27_001	ACHD	Zinger Lateral
98	4n1e28_007	ACHD	McMillan Lateral
99	4n1e28_008	ACHD	McMillan Lateral
100	4n1e33_003	ACHD	North Slough
101	4n1e33_004	ACHD	North Slough
102	4n1e33_006	ACHD	North Slough
103	4n1e34_007	ACHD	Shavrer Lateral
104	4n1e34_019	ACHD	Karnes Lateral
105	4n1e34_021	ACHD	Shavrer Lateral
106	4n1e35_007	ACHD	Zinger Lateral
107	4n1e36_002	ACHD	Settler's Canal
108	4n1e36_007	ACHD	Settler's Canal
109	4n1e36_010	ACHD	Settler's Canal
110	4n2e18_006	ACHD	Pierce Creek
111	4n2e19_004	ACHD	Eagle Drain
112	4n2e19_005	ACHD	Eagle Drain
113	4n2e19_014	ACHD	Eagle Drain
114	4n2e19_017	ACHD	Eagle Drain
115	4n2e19_025	ACHD	Eagle Drain
116	4n2e19_026	ACHD	Eagle Drain
117	4n2e26_005	ACHD	Crane Creek
118	4n2e26_008	ACHD	Crane Creek
119	4n2e28_005	ACHD	Stewart Gulch
120	4n2e28_009	ACHD	Boise City Canal
121	4n2e29_002	ACHD	Boise City Canal
122	4n2e29_007	ACHD	Farmer's Union Canal
123	4n2e30_008	ACHD	Dry Creek Canal
124	4n2e30_011	ACHD	Dry Creek Canal

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2019-2020 cont.

#	Outfall ID	Ownership	Receiving Water
125	4n2e30_014	ACHD	Boise River
126	4n2e31_003	ACHD	Settler's Canal
127	4n2e31_012	ACHD, Private	Thurman Mill Canal
128	4n2e31_015	ACHD	Boise River
129	4n2e31_022	ACHD	Davis Drain
130	4n2e32_008	ACHD	Boise River
131	4n2e32_009	ACHD	Farmer's Union Canal
132	4n2e34_001	ACHD	Crane Creek
133	4n2e34_004	ACHD	Crane Creek
134	4n2e34_011	ACHD	Crane Creek
135	4n2e34_018	ACHD	Crane Creek
136	4n2e34_019	ACHD	Crane Creek
137	4n2e34_020	ACHD	Crane Creek
138	4n2e34_021	ACHD	Hulls Gulch
139	4n2e34_025	ACHD	Hulls Gulch
140	4n2e35_001	ACHD	Hulls Gulch

Outfall Screening Schedule 2020-2021

#	Outfall ID	Ownership	Receiving Water
1	2n3e07_003	ACHD	Fivemile Creek
2	3n1e01_006	ACHD	North Slough
3	3n1e02_002	ACHD	North Slough
4	3n1e02_011	ACHD	South Slough
5	3n1e02_014	ACHD	North Slough
6	3n1e03_004	ACHD	North Slough
7	3n1e03_011	ACHD	South Slough
8	3n1e03_014	ACHD	Settler's Canal
9	3n1e03_017	ACHD	South Slough
10	3n1e10_007	ACHD	Settler's Canal Lateral
11	3n1e10_009	ACHD	Settler's Canal
12	3n1e11_001	ACHD	Ridenbaugh Canal
13	3n1e11_003	ACHD	South Slough
14	3n1e11_010	ACHD	Collis Lateral
15	3n1e12_001	ACHD	South Slough
16	3n1e12_003	ACHD	South Slough
17	3n1e12_004	ACHD	South Slough
18	3n1e12_008	ACHD	Ridenbaugh Canal
19	3n1e12_025	ACHD	Ridenbaugh Canal
20	3n1e12_030	ACHD	Ridenbaugh Canal
21	3n1e15_001	ACHD, Irrigation	Ridenbaugh Canal
22	3n1e15_014	ACHD	Fivemile Creek
23	3n1e23_001	ACHD	Fivemile Creek
24	3n1e23_013	ACHD	Fivemile Creek
25	3n2e03_005	ACHD	Boise City Canal
26	3n2e03_015	ACHD	Boise City Canal
27	3n2e04_015	ACHD	Lowell Drain
28	3n2e04_016	ACHD	Crane Creek
29	3n2e04_020	ACHD	Boise City Canal
30	3n2e04_024	ACHD	Crane Creek
31	3n2e05_015	ACHD	Davis Drain

#	Outfall ID	Ownership	Receiving Water
32	3n2e06_010	ACHD, ITD	Davis Drain
33	3n2e06_022	ACHD	Ash Lateral
34	3n2e06_023	ACHD	North Slough
35	3n2e07_010	ACHD	Ridenbaugh Canal
36	3n2e07_015	ACHD	Ridenbaugh Canal
37	3n2e07_019	ACHD	Ridenbaugh Canal
38	3n2e08_005	ACHD, Private	North Slough
39	3n2e08_016	ACHD	North Slough
40	3n2e08_024	ACHD	North Slough
41	3n2e08_025	ACHD	North Slough
42	3n2e08_030	ACHD	North Slough
43	3n2e09_025	ACHD	Boise River
44	3n2e10_001	ACHD, Private	Boise City Canal
45	3n2e10_012	ACHD	Boise River
46	3n2e10_039	ACHD	Boise City Canal
47	3n2e14_001	ACHD	Logger Creek
48	3n2e14_012	ACHD	Boise River
49	3n2e14_013	ACHD	Boise River
50	3n2e14_019	ACHD	Logger Creek
51	3n2e15_001	ACHD	Ridenbaugh Canal
52	3n2e15_010	ACHD	Ridenbaugh Canal
53	3n2e15_011	ACHD	Ridenbaugh Canal
54	3n2e16_001	ACHD	Powell Lateral
55	3n2e17_007	ACHD	Ridenbaugh Canal
56	3n2e17_010	ACHD	Rust Lateral
57	3n2e17_015	ACHD	Ridenbaugh Canal
58	3n2e17_024	ACHD	Farmer's Lateral
59	3n2e17_031	ACHD	Rust Lateral
60	3n2e17_032	ACHD	Ridenbaugh Canal
61	3n2e17_033	ACHD	Ridenbaugh Canal
62	3n2e17_042	ACHD	Ridenbaugh Ditch

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2020-2021 cont.

#	Outfall ID	Ownership	Receiving Water
63	3n2e18_016	ACHD	Ridenbaugh Canal
64	3n2e18_019	ACHD	Ridenbaugh Ditch
65	3n2e19_004	ACHD	Threemile Creek
66	3n2e20_009	ACHD	Threemile Lateral
67	3n2e20_011	ACHD	Threemile Lateral
68	3n2e20_020	ACHD	Threemile Creek
69	3n2e20_021	ACHD	Threemile Creek
70	3n2e22_004	ACHD	Ridenbaugh Canal
71	3n2e23_002	ACHD	Logger Creek
72	3n2e23_005	ACHD	Logger Creek
73	3n2e23_007	ACHD	Bubb Canal
74	3n2e24_006	ACHD	Boise River
75	3n2e24_007	ACHD	Boise City Canal
76	3n2e24_015	ACHD, Private	Lake Heron-lateral of
77	3n2e24_031	ACHD	Watson Drain
78	3n2e27_001	ACHD	New York Canal
79	3n2e27_004	ACHD, ITD	New York Canal
80	3n2e32_001	ACHD	Fivemile Creek
81	3n2e33_001	ACHD	Fivemile Creek
82	3n3e20_001	ACHD	Penitentiary Canal
83	4n1e13_009	ACHD	Eagle Drain
84	4n1e13_011	ACHD	Eagle Drain
85	4n1e21_001	ACHD, Private	Thurman Mill Canal
86	4n1e23_001	ACHD	Dry Creek
87	4n1e23_002	ACHD	Elmore Drain
88	4n1e23_003	ACHD	Elmore Drain
89	4n1e24_008	ACHD	Elmore Drain
90	4n1e24_012	ACHD	Elmore Drain
91	4n1e24_026	ACHD	Boise River
92	4n1e25_006	ACHD	Warm Springs Canal
93	4n1e25_007	ACHD	Warm Springs Canal

#	ID_OFPT	OWNERSHIP	REC_WATER
94	4n1e25_009	ACHD	Warm Springs Canal
95	4n1e25_027	ACHD	Thurman Mill Canal
96	4n1e26_002	ACHD	Thurman Mill Canal
97	4n1e26_013	ACHD	Thurman Mill Canal-Lateral
98	4n1e26_016	ACHD	Thurman Mill Canal
99	4n1e26_020	ACHD	Thurman Mill Canal
100	4n1e27_006	ACHD	Zinger Lateral
101	4n1e28_001	ACHD	Zinger Lateral
102	4n1e28_002	ACHD	McMillan Lateral
103	4n1e33_005	ACHD	North Slough
104	4n1e34_003	ACHD	Karnes Lateral
105	4n1e34_009	ACHD	Karnes Lateral
106	4n1e34_011	ACHD, Irrigation	Shavrer Lateral
107	4n1e34_018	ACHD	Karnes Lateral
108	4n1e35_002	ACHD	Settler's Canal
109	4n1e35_004	ACHD	Settler's Canal
110	4n1e36_004	ACHD	Settler's Canal
111	4n1e36_006	ACHD	Settler's Canal
112	4n1e36_012	ACHD	Settler's Canal
113	4n1e36_026	ACHD	Settler's Canal
114	4n1e36_029	ACHD	Settler's Canal
115	4n2e17_001	ACHD, Private	Pierce Creek
116	4n2e19_006	ACHD	Eagle Drain
117	4n2e19_015	ACHD	Eagle Drain
118	4n2e19_019	ACHD	Eagle Drain
119	4n2e19_030	ACHD, Irrigation	Eagle Drain
120	4n2e20_001	ACHD	Boise City Canal
121	4n2e21_001	ACHD	Stewart Gulch
122	4n2e26_003	ACHD	Crane Creek
123	4n2e26_009	ACHD	Crane Creek
124	4n2e28_003	ACHD	Boise City Canal

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2020-2021 cont.

#	Outfall ID	Ownership	Receiving Water
125	4n2e28_006	ACHD	Boise City Canal
126	4n2e29_001	ACHD	Boise City Canal
127	4n2e29_008	ACHD	Boise Valley Canal
128	4n2e30_009	ACHD	Boise Valley Canal
129	4n2e31_001	ACHD	Thurman Mill Canal
130	4n2e31_008	ACHD	Davis Drain
131	4n2e31_011	ACHD	Davis Drain
132	4n2e32_007	ACHD	Boise River
133	4n2e32_013	ACHD, Private	Crane Creek
134	4n2e32_026	ACHD	Boise Valley Canal
135	4n2e33_002	ACHD	Boise City Canal
136	4n2e34_003	ACHD	Crane Creek
137	4n2e34_008	ACHD	Crane Creek
138	4n2e34_016	ACHD	Crane Creek
139	4n2e34_024	ACHD	Hulls Gulch
140	4n2e35_003	ACHD	Hulls Gulch-Lateral of

Outfall Screening Schedule 2021-2022

#	Outfall ID	Ownership	Receiving Water
1	2n3e07_006	ACHD, Private	Fivemile Creek
2	3n1e01_005	ACHD	Fitz Lateral
3	3n1e01_011	ACHD	North Slough
4	3n1e02_005	ACHD	North Slough
5	3n1e02_012	ACHD	North Slough
6	3n1e03_013	ACHD	South Slough
7	3n1e10_004	ACHD	Gruber Lateral
8	3n1e11_004	ACHD	South Slough
9	3n1e11_005	ACHD	Cloverdale Lateral
10	3n1e11_007	ACHD	Ridenbaugh Canal
11	3n1e11_009	ACHD	Collis Lateral
12	3n1e12_022	ACHD	Ridenbaugh Canal
13	3n1e12_023	ACHD	Ridenbaugh Canal
14	3n1e12_024	ACHD	Ridenbaugh Canal
15	3n1e12_050	ACHD	South Slough
16	3n1e14_001	ACHD	Wilson Fruit Lateral
17	3n1e14_005	ACHD	Huntington Lateral
18	3n1e14_012	ACHD	Huntington Lateral
19	3n1e14_013	ACHD	Huntington Lateral
20	3n1e15_005	ACHD	Fivemile Creek
21	3n1e15_009	ACHD	Ridenbaugh Canal
22	3n1e15_013	ACHD	Fivemile Creek
23	3n1e23_007	ACHD	Fivemile Creek
24	3n1e23_010	ACHD	Fivemile Creek
25	3n1e23_011	ACHD	Fivemile Creek
26	3n1e24_006	ACHD	Fivemile Creek
27	3n2e03_001	ACHD	Boise City Canal
28	3n2e03_002	ACHD	Boise City Canal
29	3n2e03_007	ACHD	Boise City Canal
30	3n2e04_005	ACHD, Private	Settler's Canal Lateral
31	3n2e04_008	ACHD	Boise River

#	Outfall ID	Ownership	Receiving Water
32	3n2e04_010	ACHD	Boise River
33	3n2e04_017	ACHD	Boise City Canal
34	3n2e04_021	ACHD	Boise City Canal
35	3n2e05_001	ACHD	Davis Drain
36	3n2e05_011	ACHD	Boise River
37	3n2e05_012	ACHD	Thurman Mill Canal
38	3n2e05_013	ACHD	Settler's Canal
39	3n2e05_027	ACHD	Davis Drain
40	3n2e05_028	ACHD	Thurman Mill Canal
41	3n2e05_030	ACHD, Private	Davis Drain
42	3n2e05_039	ACHD	Davis Drain
43	3n2e05_040	ACHD	Thurman Mill Canal
44	3n2e06_006	ACHD	North Slough
45	3n2e06_008	ACHD	North Slough
46	3n2e06_013	ACHD	North Slough
47	3n2e06_021	ACHD	Davis Drain
48	3n2e07_001	ACHD	North Slough
49	3n2e08_009	ACHD	North Slough
50	3n2e08_017	ACHD	North Slough
51	3n2e08_018	ACHD	North Slough
52	3n2e08_023	ACHD, Private	North Slough
53	3n2e09_027	ACHD	Boise River
54	3n2e09_028	ACHD	Boise River
55	3n2e10_002	ACHD	Boise City Canal
56	3n2e10_003	ACHD	Boise City Canal
57	3n2e10_010	ACHD	Julia Davis Pond
58	3n2e10_038	ACHD	Boise City Canal
59	3n2e11_002	ACHD	Boise City Canal
60	3n2e13_005	ACHD	Boise City Canal
61	3n2e14_002	ACHD	Logger Creek
62	3n2e15_004	ACHD	Ridenbaugh Canal

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2021-2022 cont.

#	Outfall ID	Ownership	Receiving Water
63	3n2e16_010	ACHD	Ridenbaugh Canal
64	3n2e17_002	ACHD	Ridenbaugh Canal
65	3n2e17_006	ACHD	Ridenbaugh Canal
66	3n2e17_037	ACHD	Ridenbaugh Ditch
67	3n2e18_002	ACHD	Ridenbaugh Canal
68	3n2e18_015	ACHD	Farmer's Lateral
69	3n2e20_010	ACHD	Threemile Lateral
70	3n2e22_016	ACHD	Ridenbaugh Canal
71	3n2e23_001	ACHD	Logger Creek
72	3n2e23_003	ACHD	Logger Creek
73	3n2e23_006	ACHD	Bubb Canal
74	3n2e23_014	ACHD	Bubb Canal
75	3n2e23_015	ACHD	Bubb Canal
76	3n2e24_025	ACHD	Logger Creek
77	3n2e24_028	ACHD	Watson Drain-Lateral
78	3n2e24_040	ACHD	Logger Creek
79	3n2e25_002	ACHD	Ridenbaugh Canal
80	3n2e25_003	ACHD	New York Canal
81	3n2e26_002	ACHD	Ridenbaugh Canal
82	3n2e27_002	ACHD	New York Canal
83	3n2e27_005	ACHD	New York Canal
84	3n2e34_001	ACHD	Fivemile Creek
85	3n2e36_004	ACHD	Fivemile Creek-Trib. to
86	3n2e36_005	ACHD	Fivemile Creek-Trib. to
87	3n2e36_009	ACHD	Fivemile Creek-Trib. to
88	3n2e36_010	ACHD	Fivemile Creek-Trib. to
89	3n2e36_014	ACHD	Fivemile Creek
90	3n3e29_002	ACHD	Ridenbaugh Canal
91	4n1e13_001	ACHD	Eagle Drain
92	4n1e13_004	ACHD	Eagle Drain
93	4n1e13_019	ACHD	Eagle Drain
94	4n1e13_020	ACHD	Eagle Drain
95	4n1e14_004	ACHD	Eagle Drain
96	4n1e14_012	ACHD	Eagle Drain
97	4n1e24_001	ACHD	Eagle Drain-lateral of
98	4n1e24_002	ACHD	Eagle Drain-lateral of
99	4n1e24_007	ACHD	Elmore Drain
100	4n1e24_023	ACHD	Elmore Drain
101	4n1e24_025	ACHD	Elmore Drain
102	4n1e25_036	ACHD	Warm Springs Canal
103	4n1e26_004	ACHD	Thurman Mill Canal
104	4n1e26_009	ACHD	Warm Springs Canal
105	4n1e27_004	ACHD	Zinger Lateral
106	4n1e28_005	ACHD	McMillan Lateral
107	4n1e33_007	ACHD	North Slough
108	4n1e33_008	ACHD	North Slough
109	4n1e34_014	ACHD	North Slough
110	4n1e34_023	ACHD	Karnes Lateral
111	4n1e34_025	ACHD	Karnes Lateral
112	4n1e35_003	ACHD	Settler's Canal
113	4n1e36_001	ACHD	Settler's Canal
114	4n1e36_005	ACHD	Settler's Canal
115	4n1e36_008	ACHD	Settler's Canal
116	4n2e18_003	ACHD	Pierce Creek
117	4n2e18_005	ACHD	Pierce Creek
118	4n2e18_007	ACHD	Eagle Drain
119	4n2e19_003	ACHD	Eagle Drain
120	4n2e19_013	ACHD	Eagle Drain
121	4n2e19_021	ACHD	Eagle Drain
122	4n2e19_028	ACHD	Eagle Drain
123	4n2e26_002	ACHD	Crane Creek
124	4n2e28_010	ACHD	Stewart Gulch

This five-year outfall screening schedule has been developed to meet the Permit requirements according to the scheduling and prioritization approaches described in Section 2.2 of the Dry Weather Outfall Screening Plan.

Outfall Screening Schedule 2021-2022 cont.

#	Outfall ID	Ownership	Receiving Water
125	4n2e29_004	ACHD	Eagle Drain
126	4n2e29_006	ACHD	Farmer's Union Canal
127	4n2e29_011	ACHD	Boise City Canal
128	4n2e30_007	ACHD	Stewart Gulch
129	4n2e31_006	ACHD	Davis Drain
130	4n2e31_023	ACHD	Davis Drain
131	4n2e32_010	ACHD	Farmer's Union Canal
132	4n2e32_011	ACHD	Farmer's Union Canal
133	4n2e32_017	ACHD	Farmer's Union Canal
134	4n2e33_005	ACHD	Boise City Canal
135	4n2e33_010	ACHD	Boise City Canal
136	4n2e34_002	ACHD	Crane Creek
137	4n2e34_005	ACHD	Crane Creek
138	4n2e34_006	ACHD	Crane Creek
139	4n2e34_014	ACHD	Crane Creek
140	4n2e34_023	ACHD	Hulls Gulch

Appendix B: Standard Operating Procedures and Procedure Guidance for Dry Weather Outfall Screening

SOP110 – Discrete Grab Sample Collection

SOP111 – Low Flow Grab Sample Collection

SOP112 – Large Volume Grab Sample Collection

SOP114 – Field Filtering Procedures

SOP116 – Outfall Discharge Estimation – Bucket Method

SOP312 – YSI Model 85 Multi-parameter Meter – Operation, Calibration and Maintenance

SOP313 – pH Meter – Operation, Calibration and Maintenance

SOP318 – Flow Probe Operation

PG116 – Visual Flow Qualification

Hach Stormwater Test Kit User Manual

PHD6 Gas Monitor User Manual

Hach 2100q Turbidity Meter User Manual

SOP110 - Discrete Grab Sample Collection

A discrete grab sample is defined as an aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium.

Application:

This standard operating procedures (SOP) is intended to assist sampling personnel in the collection of a single discrete grab sample of water. This SOP is to describe procedures for collecting a discrete grab sample from flowing water in a conveyance. The sample collection should be taken through a manhole, at an outfall or point of discharge. This SOP is not appropriate for low flow conditions or large volume containers where multiple grabs are needed to fill a sample bottle. See SOP111 and SOP112 for these specific applications.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Discrete grab sample collection may be performed during all weather conditions, day or night.
- Dress appropriately for weather and traffic conditions.
- Keep work areas lit to reduce accidents and prevent contamination.
- Visit the sampling location prior to sampling to determine the best sampling approach.
- Most often the sampling location will be established and documented in a sampling plan. If this is not the case, assess sampling location and conditions to determine the best approach for sample collection.
    - Is a swing sampler needed or can the sample be safely collected by hand?
    - Is traffic control needed to access the sample location? If so, a two-person crew is required.
- What supplies will be needed?
- Pre-label sample containers, when possible.
- Prepare extra sampling containers in case a cap is dropped or container breakage.
- Extensive documentation is required if deviations from the standard operating procedures are required.
- Ensure that all required sample equipment is present.
- Be careful to minimize influence on ambient water quality conditions.

Procedures:

If sample collection will be performed using a swing sampler, follow swing sampler grab steps 1-13. If sample will be collected directly by hand, proceed to hand grab steps 1-9. Procedure should be followed in the order presented here, to prevent contamination of samples.

Discrete Grab with Swing Sampler

1. Put on one pair of sanitary disposable nitrile gloves.
2. Extend the sampling pole to the length appropriate to reach the sample location.

3. Attach sample container to the swing sampler securely, depending on flow conditions.
    - Slow to moderate flow, use 2-3 heavy duty rubber bands;
    - Fast flow, use zip ties;
    - When in doubt, use more supplies to keep from losing sampling jars.
4. Remove the sample bottle lid to a safe and clean area.
    - If single sampler, place cap face down on cooler lid or other stable surface.
    - If two-member sampling team, assistant should hold cap face down.
5. Lower the sample container attached to the swing sampler towards the flow making sure not to touch the surroundings with the sampling bottle.
    - Take extra care not to disturb sides of manhole with swing sampler. Debris can easily be dislodged and fall into the sample container.
6. Maneuver the sampling pole so flow contacts the sample container opening directly, and opening is oriented upstream [figure 1].
7. Plunge the sample bottle to the middle of the flow depth, if possible. If water is too deep, sample should be collected just below the surface of water. Slowly raise the swing sampler.
8. If cascading flow, collect sample in middle of flow as it cascades, discharging into the water body.
9. If sampling inside a manhole, collect the sample from the inlet pipe if the configuration allows.
10. If sampling for *E.coli* fill the sample container to the specified fill line.
11. For all other samples completely fill the sample container to minimize air in the sample container.
12. Raise the pole and carefully cap sample container.
    - If single sampler, slide hands up the swing sample, keeping the sample container level, until capping container is within reach.
    - If two-member sampling team, assistant can easily cap sample bottle.
13. Label sample container with sample name and collection date and time with black sharpie or *"Rite in the Rain"*® pen.
14. Record sample information on field form.
15. Place sample container in cooler on ice.
16. Repeat steps 2-12 for collection of additional samples.
17. Deliver samples to laboratory with completed chain of custody.

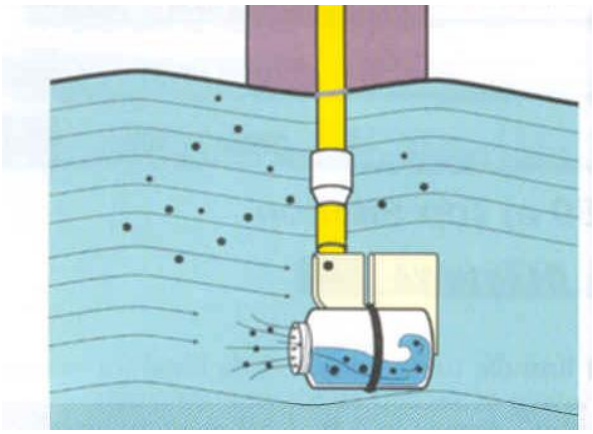

Figure 1 Swing Sampler Positioning

Discrete Grab by Hand

1. Put on one pair of sanitary disposable nitrile gloves.
2. Remove the sample bottle lid to a safe and clean area.
    - If single sampler, place cap face down on cooler lid or other stable surface.
    - If two-member sampling team, assistant should hold cap face down.
3. Orient bottle with opening opposite direction of flow and gloved hand behind bottle.
    - Water should flow directly into sample bottle opening, without flowing over bottle or hand. [Figure 2]
4. If cascading flow, collect sample in middle of flow as it cascades, discharging to water body.
5. Plunge the sample bottle to the middle of the flow depth, if possible. If water is too deep, sample should be collected just below the surface of water.
6. If sampling for *E.coli* fill the sample container to the specified fill line.

7. For all other samples completely fill the sample container to minimize air in the sample container.
8. Carefully cap sample container.
9. Label sample container with sample name and collection date and time with black sharpie or *"Rite in the Rain"*® pen.
10. Record sample information on field form.
11. Place sample container in cooler on ice.
12. Repeat steps 1-9 for collection of additional samples.
13. Deliver samples to the laboratory with completed chain of custody.



Figure 2: Container orientation by hand. Water flows into container directly. Gloved hand behind container.

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Revised by Monica Lowe, ACHD, Stormwater Quality Specialist Monica L. Lowe

Reviewed by Ted Douglass, Brown and Caldwell, Project Manager

SOP111- Low Flow Grab Sample Collection

A Low flow grab sample is operationally defined as multiple aliquots collected consecutively, with minimal lag time between aliquots, when flow conditions prevent a single aliquot sample.

Application:

This SOP is intended as a reference for sampling personnel in the collection of grab samples when a discrete grab sample (single aliquot of sample in a single point of time) is not possible due to low flow conditions. Low flow situations occur when the volume of flow is such that collecting an entire sample volume with one discrete grab sample aliquot is not possible. During these situations, ACHD and the Boise WQL will identify designated bottles to be used to transfer small aliquots of sample into a second container, until sufficient volume is achieved for laboratory analyses.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Low flow grab sample collection may be performed during all weather conditions, day or night;
- Dress appropriately for weather and traffic conditions;
- Keep work areas lit to reduce accidents and prevent contamination;
- Visit the sampling location prior to sampling to determine the best sampling approach for sample collection;
    - Is a swing sampler needed or can the sample be safely collected by hand?
    - Is traffic control needed to access the sample location? If so, a two-person crew is required.
- Prepare extra sampling containers in case a cap is dropped or container breakage.
- Be prepared for low flow grab sample collection. Know which designated bottles will be used as transfer containers.
- Extensive documentation is required if deviations from the standard operating procedures are required.
- Ensure that all required sample equipment is present.
- Be careful to minimize influence on ambient water quality conditions.

Procedures:

If sample collection will be performed using a swing sampler, follow swing sampler grab steps 1-19. If sample will be collected directly by hand, proceed to hand grab steps 1 - 27. Procedure should be followed in the order presented here, to prevent contamination of samples.

Low Flow Grab with Swing Sampler

1. Put on one pair of sanitary disposable nitrile gloves.
2. Extend the sampling pole to the length appropriate to reach the sample location.
3. Position receiving container on a flat surface, within reach of the sample location.
    - Setting the receiving container in an open cooler works well to stabilize the sample container during sample transfers.
4. Select designated sample container for transfer.

- The transfer container should be appropriate for the analysis performed according to 40 CFR 136. The transfer container should be identified by ACHD or WQL and should be labeled accordingly;
- As a general rule, use the same type of transfer bottle as the one you will be submitting for analyses;
- The transfer container should be prepared by the laboratory in the same manner as the sample container being filled. If in doubt, contact the laboratory where the sample will be submitted.

5. Attach sample container to the swing sampler securely, with 2-3 heavy duty rubber bands.
6. If single sampler, loosen cap of receiving bottle and set lid loosely on top to cover opening.
7. Maneuver the sampling pole so flow contacts the sample container opening directly and opening is oriented upstream [Figure 1].
8. Plunge the sample bottle to the middle of the flow depth, if possible. If water is too deep, sample should be collected just below the surface of water. Slowly raise the swing sampler.
9. If cascading flow, collect sample in middle of flow as it cascades, discharging into the water body.
10. If two-member sampling team, have assistant remove the lid on the receiving container.
11. Slowly pour transfer bottle contents into the receiving container while still attached to swing sampler.
    - If single sampler, slide hands down pole to transfer container and stabilize pole to pour into receiving container.
    - If two-member sample team, sampler should gently swing sampler over to assistant who will stabilize the swing sampler and transfer bottle and pour sample into receiving container.
12. Loosely cap receiving container.
13. Label receiving container with sample name and collection start time.
14. Repeat collecting aliquots of sample until bottle is full or adequate sample volume for analysis. This should be done as quickly as possible to minimize lag time between sample aliquots.
15. Tightly cap receiving container.
16. Label receiving container with sample end time.
17. Record sample information on field form.
18. Place sample container in cooler on ice.
19. Deliver samples to laboratory with completed chain of custody.

Low Flow Grab by Hand

1. Put on one pair of sanitary disposable nitrile gloves.
2. Position receiving container on a flat surface, within reach of the sample location.
    a. Setting the receiving container in an open cooler works well to stabilize the sample container during sample transfers.
3. Select designated sample container for transfer.
    a. The transfer container should be appropriate for the analysis performed according to 40 CFR 136. The transfer container should be identified by ACHD or WQL and should be labeled accordingly;
    b. As a general rule, use the same type of transfer bottle as the one you will be submitting for analyses;
    c. The transfer container should be prepared by the laboratory in the same manner as the sample container being filled. If in doubt, contact the laboratory where the sample will be submitted.
4. If single sampler, loosen cap of receiving bottle and set lid loosely on top to cover opening.
5. Maneuver the sampling pole so flow contacts the sample container opening directly and opening is oriented upstream [Figure 1].

6. Plunge the sample bottle to the middle of the flow depth, if possible. If water is too deep, sample should be collected just below the surface of water. Slowly raise the swing sampler.
7. If cascading flow, collect sample in middle of flow as it cascades, discharging into the water body.
8. If two-member sampling team, have assistant remove the lid on the receiving container.
9. Carefully pour sample aliquot into receiving container.
20. Loosely cap receiving container.
21. Label receiving container with sample name and collection start time.
22. Repeat collecting aliquots of sample until bottle is full or adequate sample volume for analysis.
23. Tightly cap receiving container.
24. Label receiving container with sample end time.
25. Record sample information on field form.
26. Place sample container in cooler on ice.
27. Deliver samples to laboratory with completed chain of custody.

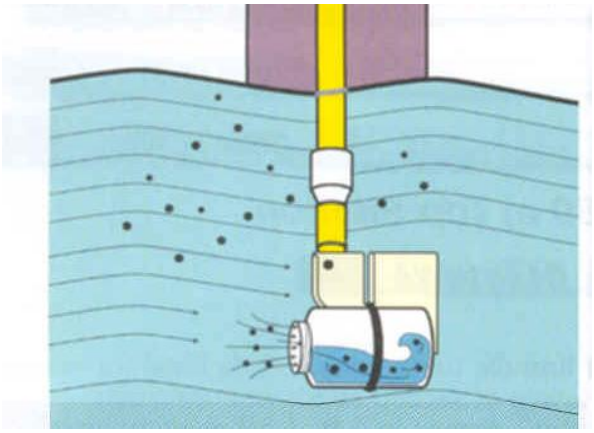

Figure 1: Swing sampler container orientation. Water flows directly into the sample container.

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Reviewed by Ted Douglass, Brown and Caldwell, Program Manager

SOP112- Large Volume Grab Sample Collection

A large volume grab sample is operationally defined as multiple aliquots of sample collected consecutively, with minimal lag time between aliquots, when laboratories request a larger volume for analysis than can be collected in a single container.

Application:

This standard operating procedure (SOP) is intended for sampling personnel in the collection of large volume grab samples when a discrete grab sample (single aliquot of sample in a single point of time) is not possible due to large sample volumes required by the laboratory. A discrete grab sample is preferred, but for certain analysis, a large volume of sample is needed by the laboratory to achieve desired detection limits. The large container, (Volumes > 1L) is often too cumbersome for a discrete grab sample, and too large to attach to a swing sampler. Therefore, a large container is filled by transferring small aliquots collected consecutively, with minimal lag time between aliquots, to achieve a large volume grab sample. ACHD and the Boise WQL will identify designated bottles to be used to transfer aliquots of sample into the large volume container.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Large volume flow grab sample collection may be performed during all weather conditions, day or night;
- Dress appropriately for weather and traffic conditions;
- Keep work areas lit to reduce accidents and prevent contamination;
- Visit the sampling location prior to sampling to determine the best sampling approach for sample collection;
    - Is a swing sampler needed or can the sample be safely collected by hand?
    - Is traffic control needed to access the sample location? If so, a two-person crew is required.
- Prepare extra sampling containers in case a cap is dropped or container breakage.
- Be prepared for large volume grab sample collection. Know which designated bottles will be used as transfer containers.
- Extensive documentation is required if deviations from the standard operating procedures are required.
- Ensure that all required sample equipment is present.
- Be careful to minimize influence on ambient water quality conditions.

Procedures:

If sample collection will be performed using a swing sampler, follow swing sampler grab steps 1-19. If sample will be collected directly by hand, proceed to hand grab steps 1 - 27. Procedure should be followed in the order presented here, to prevent contamination of samples.

Large Volume Grab Sample with Swing Sampler

1. Put on one pair of sanitary disposable nitrile gloves.

2. Extend the sampling pole to the length appropriate to reach the sample location.
3. Position receiving container on a flat surface, within reach of the sample location.
    - Setting the receiving container in an open cooler works well to stabilize the sample container during sample transfers;
    - 10 L carboys are often double bagged with polyethylene bags at the laboratory. Untie bags and push bags down around the outside of the container, so not to interfere with opening of the container.
4. Select designated sample container for transfer.
    - The transfer container should be appropriate for the analysis performed according to 40 CFR 136. The transfer container should be identified by ACHD or WQL and should be labeled accordingly;
    - As a general rule, use the same type of transfer bottle as the one you will be submitting for analyses;
    - The transfer container should be prepared by the laboratory in the same manner as the sample container being filled. If in doubt, contact the laboratory where the sample will be submitted.
5. Attach sample container to the swing sampler securely, depending on flow conditions.
    - Slow to moderate flow, use 2-3 heavy duty rubber bands;
    - Fast flow, use zip ties;
    - When in doubt, use more supplies to keep from losing sampling jars.
6. If single sampler, loosen cap of receiving bottle and set lid loosely on top to cover opening.
7. Maneuver the sampling pole so flow contacts the sample container opening directly, and opening is oriented upstream [Figure 1].
8. Plunge the sample bottle to the middle of the flow depth. If water is too deep, sample should be collected just below the surface of water. Slowly raise the swing sampler.
9. If cascading flow, collect sample in middle of flow as it cascades, discharging into the water body.
10. If two-member sampling team, have assistant remove the lid on the receiving container.
11. Slowly pour transfer bottle contents into the receiving container while still attached to swing sampler.
    - If single sampler, slide hands down pole to transfer container and stabilize pole to pour into receiving container.
    - If two-member sample team, sampler should gently swing sampler over to assistant who will stabilize the swing sampler and transfer bottle and pour sample into receiving container.
12. Loosely cap receiving container.
13. Label receiving container with sample name and collection start time.
14. Repeat collecting aliquots of sample until bottle is full or adequate sample volume for analysis. This should be done as quickly as possible to minimize lag time between sample aliquots.
15. Tightly cap receiving container.
16. Label receiving container with sample end time.
17. Record sample information on field form.
18. Place sample container in cooler on ice.
19. Deliver samples to laboratory with completed chain of custody.

Large Volume Grab by Hand

1. Put on one pair of sanitary disposable nitrile gloves.
2. Position receiving container on a flat surface, within reach of the sample location.
    a. Setting the receiving container in an open cooler works well to stabilize the sample container during sample transfers.
3. Select designated sample container for transfer.

a. The transfer container should be appropriate for the analysis performed according to 40 CFR 136. The transfer container should be identified by ACHD or WQL and should be labeled accordingly;
b. As a general rule, use the same type of transfer bottle as the one you will be submitting for analyses;
c. The transfer container should be prepared by the laboratory in the same manner as the sample container being filled. If in doubt, contact the laboratory where the sample will be submitted.

4. If single sampler, loosen cap of receiving bottle and set lid loosely on top to cover opening.
5. Maneuver the sampling pole so flow contacts the sample container opening directly [Figure 1].
6. Plunge the sample bottle to the middle of the flow depth. If water is too deep, sample should be collected just below the surface of water. Slowly raise the swing sampler.
7. If cascading flow, collect sample in middle of flow as it cascades, discharging into the water body.
8. If two-member sampling team, have assistant remove the lid on the receiving container.
9. Carefully pour sample aliquot into receiving container.
20. Loosely cap receiving container.
21. Label receiving container with sample name and collection start time.
22. Repeat collecting aliquots of sample until bottle is full or adequate sample volume for analysis.
23. Tightly cap receiving container.
24. Label receiving container with sample end time.
25. Record sample information on field form.
26. Place sample container in cooler on ice.
27. Deliver samples to laboratory with completed chain of custody.

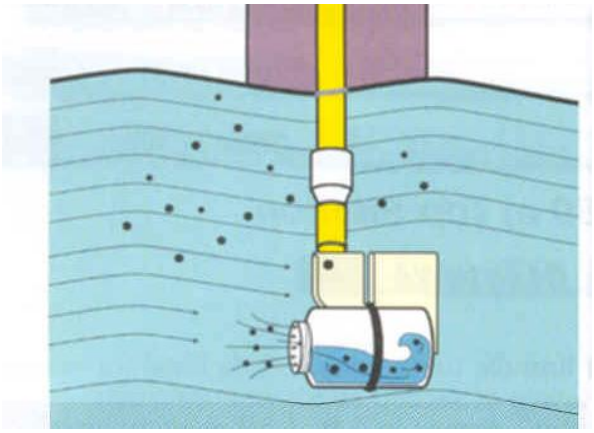

Figure 1: Swing sampler container orientation. Water flows directly into the sample container.

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SOP116 - Outfall Discharge Estimation – Bucket Method

The Bucket Method is a simple approach to estimating discharge in gallons per minute (GPM) from an outfall with low flow using a container of known volume and a stopwatch. GPM can then be converted to cubic feet per second (cfs) to match the standard flow measurement rate of the program.

Application:

This standard operating procedures (SOP) is a step by step protocol designed to assist sampling personnel in estimating discharge from an outfall with low flow. An outfall is the point where a stormwater conveyance discharges to a surface water body. The Bucket Method is simply the measurement of time needed to fill a container of known volume as it flows from an outfall. The Bucket Method is best utilized when site conditions are appropriate to allow for collection of the entire discharge without the container filling too quickly to obtain an accurate reading.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Dress appropriately for weather, traffic, and outfall access.
- Visit the sampling location and review available mapping prior to sampling to determine the best sampling approach and outfall access.
- Ideally a two-person sampling team is needed; One person to hold the bucket securely, and one person to operate the stopwatch.
- What supplies will be needed?

Procedures:

Note: This procedure specifies the use of a five-gallon bucket which is most commonly used. However, any container with a known volume can be used if it is of sufficient size to capture the entire flow.

1. Ensure the five-gallon bucket is marked clearly with the five-gallon volume indicated.
2. Put on one pair of sanitary disposable nitrile gloves.
3. Depending on the outfall access, position yourself just above the outfall discharge (preferred) or in the receiving water in front of the outfall discharge.
4. Communicate with a sampling partner (Timer) to start and stop the stopwatch as necessary.
5. Insert the bucket into the discharge such that the entire flow is being captured.
6. Once the level in bucket reaches the five-gallon volume mark, alert the timer to stop the stop watch.
7. The Timer will record the time in seconds it takes to fill the bucket on the appropriate field form.
8. Empty the bucket.
9. Repeat steps five through eight to attain three successful readings.
10. Calculate the average time to fill the bucket by adding the three times together and dividing the sum by three. Record the average time in seconds on the field form. See example calculations below for steps 10-12.

11. Convert average time in seconds to minutes by dividing the average time in seconds by 60 seconds per minute.
12. Calculate the GPM by dividing 5 gallons by the averaged time calculation in minutes from step 11. Record the value in GPM on the field form.

Calculating the Discharge – Example

A clean 5 gallon bucket was placed under the flow of a discharge pipe. The bucket was filled three consecutive times resulting the in following times: 15 seconds, 18 seconds and 14 seconds.

Calculate average time:
Add the three recorded times together and divide by three to obtain the average fill time.

$$\text{Average time} = \frac{15 + 18 + 14}{3} = 15.7 \text{ sec}$$

Convert average time in seconds to minutes:
Divide average time by 60 to convert time to minutes.

$$\text{Average time} = \frac{15.7 \text{ sec}}{60} = 0.26 \text{ min}$$

Calculate the site discharge in GPM:
Divide the volume of the container (gallons) by the average time needed to fill the container (minutes).

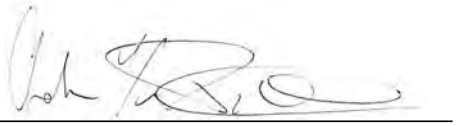
$$\text{Discharge} = \frac{5 \text{ gal}}{0.26 \text{ min}} = 19.2 \text{ gpm}$$

Convert the site discharge to cfs:
Multiply discharge in GPM by 0.00223 to obtain discharge in cfs.
Discharge = 19.2 gpm x 0.00223 = 0.043

Report discharge in cfs.

References:

Estimation Discharge and Stream Flows: A Guide for Sand and Gravel Operators, July 2005 Department of Ecology.

Prepared by Adam Van Patten, ACHD, Stormwater Quality Specialist 

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Reviewed by Ted Douglass, Brown and Caldwell, Stormwater Quality Project Manager_____

SOP318 - Flow Probe Operation

The Flow Probe by Global Water Instrumentation is designed to measure the average velocity (V) in a flow stream. The cross-sectional area (A) can be measured by manually measuring the depth of flow at several points across the flow. With these two values, flow (Q) = VA, can be estimated.

Application:

This standard operating procedure (SOP) is intended for sampling personnel for measurement of flow in a stream channel using a Flow Probe (probe) by Global Water. The probe measures velocity of stream flow. Due to the variability in velocity measurements discussed below, an average velocity reading will be calculated by the probe during a set interval of time. To obtain the most accurate velocity reading, three procedures are outlined below depending on the size of the stream.

The following procedure outlines how to record an average velocity (V). To calculate flow (Q=VA) the cross-sectional area must also be determined. The cross-sectional area is measured by manually measuring the width and depth of the stream at several points across the flow [Figure 1] and constructing a diagram of the cross section.

The volumetric flow rate of water, which is commonly called discharge (Q), is the product of multiplying the average velocity (V) by the total cross-sectional area (A). The **velocity-area method** measurement is made by subdividing a stream cross-section into segments (sometimes referred to as sections, verticals, profiles, panels, or ensembles) and by measuring the depth and average velocity in a vertical profile within each segment.

By dividing the stream width into subsections (streams less than 10 feet in width have 10 subsections, and streams greater than 10 feet in width have 20 subsections), total discharge is equal to the sum of the individual discharge measurements in each subsection. Individual point velocity (V) is measured at each subsection, and the subsection discharge is equal to the product of the point velocity and cross-sectional area (a) within the subsection. The cross-section is defined by depths at verticals 1,2,3,4,....*n*.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Dress appropriately for weather and traffic conditions;
    - Is traffic control needed to access the sample location? If so, a two-person crew is required.
    - Should waders and/or personal floatation device (PFD) be used? If risk of drowning, a PDF is required. Use caution when wading in streams due to hazards of wet, unstable footing of stream bed and flowing water. A two-person crew is required.
- Visit the sampling location prior to sampling to determine the best approach for flow measurements.
    - Will an extension pole be needed if collecting measurements from a bridge?
    - Is there a relatively straight section of flow with little turbulence?
    - Is the stream shallow enough to wade?
    - Is there access within the public right-of-way or private property issued to address?
    - What is the best way to determine subsections if the stream is wide?

Flowing water varies in velocity for two main reasons:

- Velocities vary across the cross-section. In general, the velocities are greater in the center of the flow and lesser near the bottom and sides of the channel.

* The water surges in velocity with time. In a smooth running stream the velocity at a specific point can easily vary 1-2 feet per second over the period of a minute. The pulsating or surging of the flow should be averaged to get a good average flow reading.

Procedures: The following procedures are based on manufacturer recommendations. The user's manual is available in Appendix B or at www.**global**w.com/downloads/**flow**probe/**flow**probe_**manual**_past.pdf.

Obtaining an Average Velocity Reading

1. Remove the probe from the protective case by unscrewing the top cap. Case can also be opened by releasing the side latch if the top cap is difficult to unscrew.
2. Blow air strongly through the flow propeller [Figure 2] in the direction of the arrow to ensure the propeller can spin freely.
3. Lower the flow propeller into the water column oriented so the flow of water is the same direction as the black arrow on the flow propeller.
4. Press and hold button located on top of the display [Figure 3] labeled "Reset" for six seconds to zero the instrument.

A. Small Streams and Pipes (probe can be moved slowly and smoothly throughout the flow)

5. Press the bottom button "MODE" on the flow probe computer. Average velocity is displayed as "AVGSPEED" and maximum velocity is displayed as "MAXSPEED".
6. Move the probe smoothly and evenly back and forth across the flow and from top to bottom of the water column so that the probe stays on each point in the flow for the same amount of time. (The motion is like applying an even coat of spray paint over the entire surface.)
7. Measure the depth of flow using a measuring stick or measuring tape in the center of the area where the average velocity reading was recorded.

B. Large Streams and Rivers (divide width of flow into 2-3 foot subsections)

5. Press the bottom button "MODE" on the flow probe computer. Average velocity is displayed as "AVGSPEED" and maximum velocity is displayed as "MAXSPEED".
6. Move the probe vertically from the surface of the water to the bottom slowly and smoothly.
7. Move the probe up and down for 40 seconds to obtain a good average. Repeat step 7 every subsection across the stream.
8. The average velocity multiplied by the area of the subsection is the flow for the subsection. Add all the subsection flows to obtain the total stream flow [Figure 4].

C. Alternate Method

The probe can also be used for the "6 tenths method". Procedure B is the recommended procedure for large streams that is recommended by the manufacturer.

5. The probe is held at the center of the subsection at a depth (from the surface) of 0.6 of the total depth. The 0.6 of the total depth is assumed to be the average velocity point for the vertical profile. It is therefore the average velocity for the subsection as in procedure B above.
6. Press the bottom button "MODE" on the flow probe computer. Average velocity is displayed as "AVGSPEED" and maximum velocity is displayed as "MAXSPEED".
7. Average the velocity over a 40 second period.
8. Repeat step 7 every 2-3 foot subsections across the stream. Add all the subsection flows to obtain the total stream flow [Figure 4].

Deviations

The nature of instream flow monitoring may require deviations from the aforementioned standard operating procedures. In the event that deviations from these standard operating procedures is required, the field team will document and describe in detail the specific deviations conducted during the event.



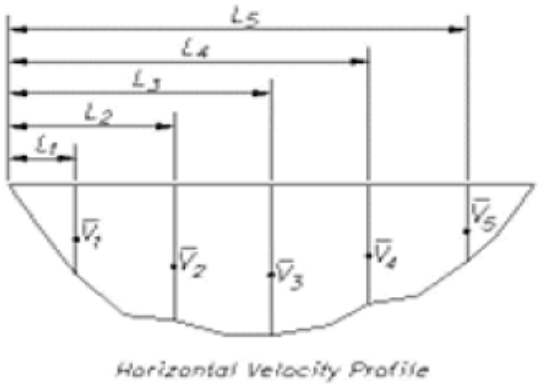
Figure 1: Sampling Multiple points across a transect



Figure 2: Flow Probe Propeller



Figure 3: Flow Probe Computer



Horizontal Velocity Profile

$$q_{3\text{-}4} = [\frac{\nabla_3 + \nabla_4}{2}][\frac{D_3 + D_4}{2}](L_4 - L_3)$$

q = the discharge in cubic feet per second (ft^3/s) for a partial area
Q = total discharge
∇ = the mean velocity associated with the partial area
a = partial area of total cross section
$L_1, L_2, \ldots L_n$ = distance to vertical measurement locations in feet from an initial point to vertical station
ΔL = the distance in feet between consecutive vertical measurement stations
$\nabla_1, \nabla_1, \ldots \nabla_n$ = the respective mean velocities in feet per second at vertical measurement stations
$D_1, D_2, \ldots D_n$ = the water depths in feet at verticals
n = the number of verticals related to the partial area

Figure 4: Velocity Profile Segments and Discharge Calculation

Source: US Department of Interior Bureau of Reclamation, Water Management Manual, Revised reprinted 2001.

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Reviewed by Ted Douglass, Brown and Caldwell, Project Manager_____

Appendix A

Calculations for Partially Filled Round Pipes

XI. Appendix B: Calculations for Flow in Partially Filled Pipes

B	C	B	C
0.01	0.0013	0.51	0.4027
0.02	0.0037	0.52	0.4127
0.03	0.0069	0.53	0.4227
0.04	0.0105	0.54	0.4327
0.05	0.0147	0.55	0.4426
0.06	0.0192	0.56	0.4526
0.07	0.0242	0.57	0.4625
0.08	0.0294	0.58	0.4723
0.09	0.0350	0.59	0.4822
0.10	0.0409	0.60	0.4920
0.11	0.0470	0.61	0.5018
0.12	0.0534	0.62	0.5115
0.13	0.0600	0.63	0.5212
0.14	0.0668	0.64	0.5308
0.15	0.0739	0.65	0.5404
0.16	0.0811	0.66	0.5499
0.17	0.0885	0.67	0.5594
0.18	0.0961	0.68	0.5687
0.19	0.1039	0.69	0.5780
0.20	0.1118	0.70	0.5872
0.21	0.1199	0.71	0.5964
0.22	0.1281	0.72	0.6054
0.23	0.1365	0.73	0.6143
0.24	0.1449	0.74	0.6231
0.25	0.1535	0.75	0.6318
0.26	0.1623	0.76	0.6404
0.27	0.1711	0.77	0.6489
0.28	0.1800	0.78	0.6573
0.29	0.1890	0.79	0.6655
0.30	0.1982	0.80	0.6736
0.31	0.2074	0.81	0.6815
0.32	0.2167	0.82	0.6893
0.33	0.2266	0.83	0.6969
0.34	0.2355	0.84	0.7043
0.35	0.2450	0.85	0.7115
0.36	0.2546	0.86	0.7186
0.37	0.2644	0.87	0.7254
0.38	0.2743	0.88	0.7320
0.39	0.2836	0.89	0.7384
0.40	0.2934	0.90	0.7445
0.41	0.3032	0.91	0.7504
0.42	0.3130	0.92	0.7560
0.43	0.3229	0.93	0.7612
0.44	0.3328	0.94	0.7662
0.45	0.3428	0.95	0.7707
0.46	0.3527	0.96	0.7749
0.47	0.3627	0.97	0.7785
0.48	0.3727	0.98	0.7816
0.49	0.3827	0.99	0.7841
0.50	0.3927	1.00	0.7854

H= Height of water; D= Diameter of pipe (in feet)

H/D = Column B

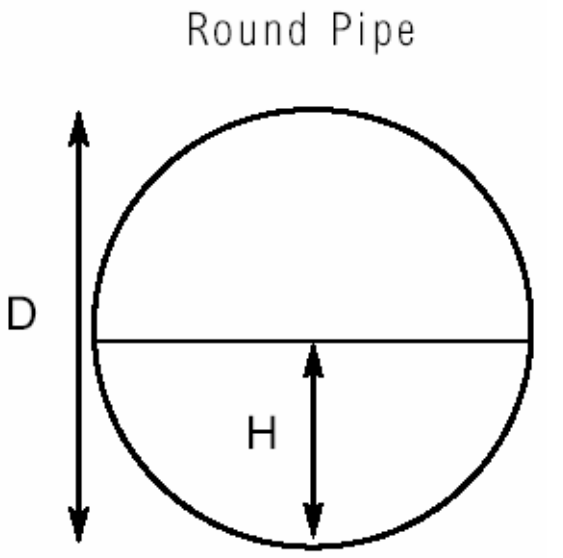
Read Column C adjacent to your pipe's B

C x D2 = Filled area, A (sq.ft.)

A x Average Velocity = Volumetric flow (CFS)

CFS x 448.83 = Gallons/minute (GPM)

GPM x 1440 = Gallons/day (GPD)



Appendix B

FP101-FP201 Global Flow Probe
User's Manual

Global Water
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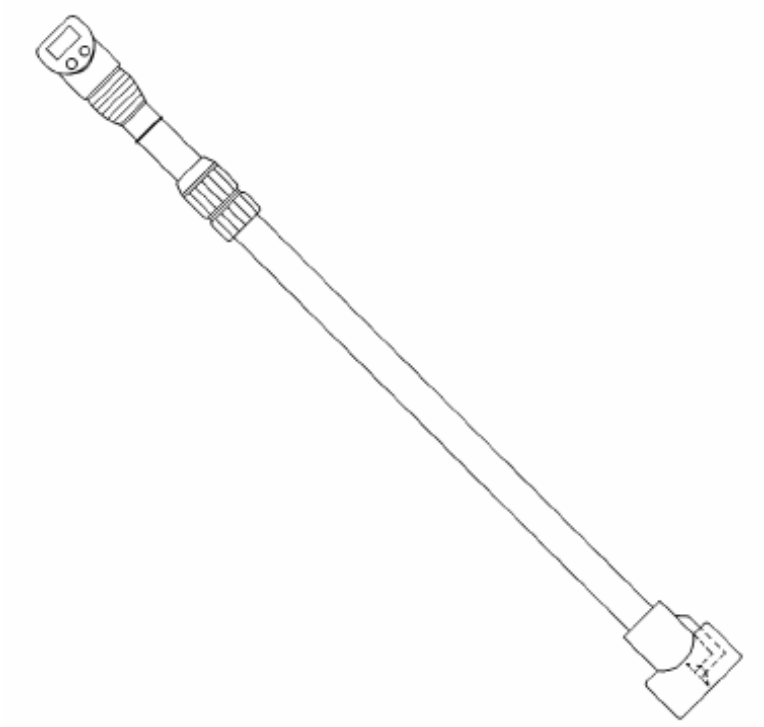
FP101-FP201 Global Flow Probe

User's Manual



Global Water

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Congratulations on your purchase of the Global Water Flow Probe. This instrument has been quality tested and approved for providing accurate and reliable measurements. We are confident that you will find the sensor to be a valuable asset for your application. Should you require assistance, our technical staff will be happy to help.

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I. Flow Probe Checklist

a. Flow Probe

b. Flow Probe Manual

II. Inspection

a. Your Flow Probe was carefully inspected and certified by our Quality Assurance Team before shipping. If any damage has occurred during shipping, please notify Global Water Instrumentation, Inc. and file a claim with the carrier involved.

   Use the checklist to ensure that you have received everything needed to operate the Flow Probe.

III. General Instructions

a. Make sure the Flow Probe's propeller turns freely by blowing strongly on the prop.
b. Point the propeller directly into the flow you wish to measure. Face the arrow inside the prop housing downstream. The FP101 probe handle is a two piece rod expandable from 3' to 6', and the FP201 is a three section rod expandable from 5' to 15'. To expand the rod for correct placement in flow, loosen the locking nut on the handle, pulling out the top piece and retightening the nut.
c. Use the bottom button to scroll through the functions until "AVGSPEED" appears. The top number is the instantaneous velocity to the nearest .5 ft/second. The lower display is the average velocity. Pressing the top button for 3 seconds will clear the average and start a new reading. While taking an average reading the maximum velocity will also be recorded. Pushing the bottom button until "MAXSPEED" is displayed causes the lower display to indicate this value. While on this screen, pressing the top button for 3 seconds will clear this value. While on the average or maximum screens pressing the top button for 5 seconds will clear both of these functions.
d. To make a measurement, place the propeller at the desired measuring point and hold the top button for 3 seconds to clear the value or 5 seconds to clear both average and maximum values. Hold the probe in place until the reading becomes steady and remove the probe from the water. The average and maximum velocities remain in their respective screens. These values are only updated while the propeller is turning. See the Average Velocity section for more information.
e. Measure/calculate the cross-sectional area of your flow stream in square feet. If you are measuring flow in round pipes, measure the depth of water and use the enclosed tables to determine cross-sectional area (see Appendix B: Calculations for Flow in Partially Filled Pipes). If you are measuring flow in another channel type, manually measure water depth at several points across the flow. These measurements are most easily recorded by drawing a diagram on graph paper with a scale of 1 square foot per graph paper square. Cross-sectional area (in square feet) can then be found by counting the number of squares in the stream.

f. The average velocity (calculated with the Flow Probe in feet/second) times the cross-sectional area (square feet) equals flow in cubic feet per second (cfs), or Q = V x A.
g. If the propeller gets fouled while measuring flow, clean it until the prop turns freely and start over.

IV. Average Velocity

The Flow Probe is used to measure the average water velocity. Streamflow velocity varies for two reasons:

a. The velocities vary throughout the flow's cross-section. In general, the velocities are greater in the center of the flow and less near the bottom and sides of the channel.

b. The water surges in velocity with time. In a smooth running stream, the velocity at a specific point can easily vary 1-2 feet per second over the period of a minute. This pulsating or surging of flow should be averaged to obtain an accurate average flow reading (leave the probe in the flow through a series of flow surges).

The Flow Probe can be used in three ways to determine average velocity in a stream.

a. For small streams and pipes, the probe can be moved slowly and smoothly throughout the flow during average velocity measurement. Move the probe smoothly and evenly back and forth from top to bottom of the flow so that the probe stays at each point in the flow for approximately the same amount of time. Keep moving the probe for 20-40 seconds to obtain an accurate average value that accounts for surging. (Move the probe as if you were spray painting and attempting to get an even coat of paint over the entire surface.)

The Flow Probe uses true velocity averaging. When the average and maximum velocities are zeroed by pushing the top button, a running average is started. As long as the probe remains in the flow, the averaging continues. One reading is taken per second, and a continuous average is displayed. For example, after 10 seconds, 10 readings are totaled and then divided by 10 and this average is displayed. Once the average reading becomes steady, the true average velocity of the stream is obtained. When you pull the probe from the water, this average value is frozen on the display until it is reset.

b. For larger streams and rivers where the Flow Probe can't easily be moved throughout the flow, divide the stream into subsections 2-3 feet wide. We recommend dividing subsections on your graph paper diagram of the flow profile. Run a measuring tape across the stream for reference. Obtain a vertical flow profile at the center of each subsection: zero the averaging function and move the Flow Probe vertically from the surface to the bottom, up and down, slowly and smoothly for 20-40 seconds to obtain a good average. The average velocity (obtained with the Flow Probe) times the area of the subsection (use your graph paper diagram) equals the flow for the subsection (Q=VxA).Once the flow of each subsection is obtained, add all of the subsection flows to obtain the Total Streamflow.

c. For the USGS "6 tens method", the Flow Probe is placed at the center of the subsection at a depth from the surface of 0.6 of the total depth. The Flow Probe is held in place and the average velocity is obtained over a period of 40 seconds. The 0.6 depth is assumed to be the average velocity point for the vertical profile. Therefore, this average is similar to that obtained in technique 2 (above) however; we feel that technique 2 is more accurate.

V. Computer Operation

a. The Flow Probe is calibrated at the factory. When you receive the product, you may wish to set the computer's clock (see Computer Set-up), otherwise you should not have to alter any of your computer settings. You will have to recalibrate the computer when you change the unit's battery (See Appendix A: Computer Setup). Normal battery life for the Flow Probe is 3 years or more.

b. The Flow Probe computer has a simple 2-button operation. The bottom button scrolls between functions and the top button resets the function's value. Pressing the top button for 3 seconds zeros the average and maximum velocities. With a little practice, the buttons can be pushed with the hand holding the top of the probe.

c. The computer functions are as follows:
   - Velocity: The upper display number is the instantaneous velocity to the nearest .5 foot (or meter, depending on units being used) per second.
   - The lower display number is used for the following functions: average velocity(AVGSPEED), maximum velocity(MAXSPEED), stop watch(STPWATCH) and CLOCK.
   - The bottom button scrolls between these functions, and also DIST/DAY, RIDETIME, TRIP UP, and TOTALODO which are not used for this application.
   - Push the top button for 3 seconds to reset the displayed function. Push for 5 seconds to reset all velocity functions.
   - Stop watch: While STPWATCH is displayed, pressing the top button once will start the stop watch. Pressing a second time stops the watch. Holding the button for 3 seconds clears it.
   - Clock: The computer returns to the clock function after a period of inactivity for the probe.

VI. Specifications

Range:	0.3-15 FPS (0.1-4.5 MPS)
Accuracy:	0.1 FPS
Averaging:	True digital running average. Readings taken once per second.
Display:	LCD
Sensor Type:	Protected Turbo-Prop propeller with electro-magnetic pickup.
Weight:	2 Lbs (10 lbs. U.S., 14 lbs. international shipping weight)
Size:	Length: FP101 3' to 6'; FP201 5' to 15'
Materials:	PVC, anodized aluminum, stainless steel bearing
Power:	Internal watch type batteries/1 year life
Operating Temperature:	0° to 120° F
Carrying Case:	The Flow Probe is shipped in a padded carrying case.

VII. Maintenance

a. Probe Handle:
When the Flow Probe expansion joint becomes submerged, water will enter the Probe handle. After use, dry the Probe by separating the two handle sections, draining the water inside the Probe handle, and letting the handle dry out in a warm place before reassembling. The Flow Probe handle can be cleaned with mild soap and water. DO NOT submerge the top of the pole and the computer. If the computer gets submerged, remove it from the Flow Probe, DRY IMMEDIATELY with a soft cloth; remove the battery and place in a warm place overnight to dry.

b. Battery Replacement:
The Computer is held onto the head of the Probe by a twist lock connection. To remove, turn Computer ¼ turn to the left and pull off. To remove the battery use a small coin to twist the battery cover on

the back of the computer, ¼ turn to the left. Replace battery, + side toward battery cover, using a CR2032, 3 volt lithium cell. After replacing battery the calibration numbers will require resetting. (See Appendix A: Computer Setup)

c. Cleaning:
Make sure the Turbo Prop turns freely before and after your measurements. Blow on the prop in the direction of flow. The prop should turn freely. If not, rinse the probe in clean water and remove any visible strings or hair materials from the prop bearing. This should correct the problem. If the prop still does not turn freely, remove the prop screw and the prop, and wash them in clean water or soap and water. Replace prop and screw. Tighten screw firmly but make sure prop still spins freely.

VIII. Trouble Shooting

Issue: Computer reading incorrectly

a. Blow on the propeller. The prop should spin freely and make a noise (chatter) when you blow on it. The prop should be loose on the shaft when you push it with your finger. If prop does not spin freely, rinse it with clean water or soak it in mild soapy water.
b. A small metal magnet covered with clear adhesive is installed on the back side of the prop on one blade. Be sure the magnet is in place and has not been removed. This magnet is necessary to make the signal for the computer.
c. Remove the computer holder from the pole handle by pulling the holder up away from the pole. The holder should come off with a popping sound. Make sure there is no moisture around the plug or socket. If the plug and socket are wet, dry the parts off and place both in a warm place overnight. Push the computer holder back on to handle HARD until you hear a "pop" or "snap" sound. If you don't hear this sound, the holder is not on all the way or you have a defective socket connector. Zero the "av" mode and blow on the prop for 5 to 7 seconds. You should see a number in "av" if the unit is working.
d. The computer can be removed from the holder by turning it ¼ turn to the left and lifting. Check the two electrical contacts on computer holder and the mating spring contacts on the computer. Make sure they are clean and dry.
e. Reinstall the computer on the computer head in the opposite manner that it was removed. Spin the propeller, by blowing on it, and check for an average reading. If there is still no reading contact Global Water.
f. If the display becomes weak or does not light up at all, replace the battery.

Other issues

a. Call Global Water for tech support: 800-876-1172 or 916-638-3429 (many problems can be solved over the phone). Fax: 916-638-3270 or Email: globalw@globalw.com.

   When calling for tech support, please have the following information ready;

1. Model #.
2. Unit serial number.
3. P.O.# the equipment was purchased on.
4. Our sales number or the invoice number.
5. Repair instructions and/or specific problems relating to the product.

Be prepared to describe the problem you are experiencing including specific details of the application, installation, and any additional pertinent information.

b. In the event that the equipment needs to be returned to the factory for any reason, please call to obtain a RMA# (Return Material Authorization). Do not return items without a RMA# displayed on the outside of the package.

   Clean and decontaminate the FP101/201 if necessary.

   Include a written statement describing the problems.

   Send the package with shipping prepaid to our factory address. Insure your shipment; Global Water's warranty does not cover damage incurred during transit.

IX. Warranty

c. Global Water Instrumentation, Inc. warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from factory. Global Water's obligations under this warranty are limited to, at Global Water's option: (I) replacing or (II) repairing; any products determined to be defective. In no case shall Global Water's liability exceed the products original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by Global Water Instrumentation, Inc., or which has been subject to misuse, negligence or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

d. The warranty begins on the date of your invoice.

X. Appendix A: Computer Setup

The BC1200 has the capability to switch between 2 different calibration factors. To change between the calibrations remove the computer from the flow probe head by twisting 45 degrees counter clockwise and lifting. The indented gray button in the upper left corner on the back is to switch between CAL I and CAL II. In the upper left corner of the display, I is displayed for CAL I and II is displayed for CAL II.

Note:
I = ft/sec, calibration # = 0053
II = m/sec, calibration # = 0016
The indented gray button on the upper right is used to enter the calibration mode. Press and hold it for 5 seconds to enter calibration mode.

TO RESET THE CALIBRATION:
(Calibration #'s are factory set. Resetting is only required after changing the battery.)

- Press bottom button until CLOCK or TOTALODO is not displayed on screen.
- Press the left indented gray button to select CAL I.
- Turn computer over and press and hold the right indented gray button for 5 seconds and "set language" flashes on display.
- Press top button to select language.
- Press bottom button to accept.
- Press top button until "SET M" is displayed.
- Press bottom button to accept. The calibration factor is now displayed.
- Pressing the top button will change the value of the flashing digit.
- Pressing the bottom button will accept this value and move to the next digit.
- Set the calibration factors as follows:
  - Feet/second: 0053 (CAL I)
  - Meters/second: 0016 (CAL II)
- Press indented right button on back for one second to store.

Repeat above procedure for Cal II. (Only the cal number will be required)

(NOTE: after battery replacement and additional screen displaying SET ODO will follow the forth digit of the cal number. Ignore this and press the indented gray button to store settings)

TO SET CLOCK

- Press bottom button until clock appears at the bottom of the screen.
- Turn computer over and press and hold the right indented gray set button (S) for 5 seconds or until clock flashes.
- Press top button until hour is reached.
- Press bottom button to move to minutes.
- Press top button until desired number is reached.
- Press bottom button to move to single minutes.
- Press top button until desired single minute is reached.
- Turn computer over and press right indented gray set button for 1 second to save.

PG 116– Visual Flow Qualification

A visual flow qualification is a description of the amount of flow observed from an outfall. The varying amount of flow observed is grouped into three categories: Trickle, Moderate, or Substantial.

Application:

This guidance contains examples of varying flow amounts to assist sampling personnel with visually qualifying outfall discharges into three categories: Trickle, Moderate, or Substantial. Visual qualification of flow will be observed during all outfall investigations. Flow observations are best made from the outfall point where it discharges into the receiving water but if access does not allow, observations can be taken from the nearest accessible drainage pipe.

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Dress appropriately for weather, traffic, and outfall access.
- Review available mapping prior to the investigation to determine the safest approach for outfall access.
- What supplies will be needed?

Procedures:

1. Gain access to the outfall following one of the three following options. Safety takes precedence over access and efficiency – do not put yourself at risk of injury.
    a. Preferably, observations would be made from the bank opposite the outfall, allowing for full visual of the flow exiting the outfall.
    b. Observations can be made from the bank adjacent the outfall as well, but this approach may limit the observer's ability to see the flow as it exits the outfall.
    c. If outfall access is not possible, flow can be observed from the nearest connecting drainage feature such as a drop inlet, manhole, open ditch, pond, or irrigation box. Accessing flow from connecting drainage features may require special tools such as a manhole puller, hammer, pry bar, gas meter, and flashlight.
2. Visually categorize the outfall discharge based on the following criteria:
    a. Trickle: very narrow stream of water
    b. Moderate: steady stream of flow, but very shallow depth
    c. Substantial: steady stream of flow with depth.

Trickle: narrow stream



Moderate: steady stream, but shallow



Substantial: steady stream with depth



3. Record the flow category on the appropriate field form.

Resources:

Brown, E., D. Caraco, and R. Pitt. 2004. Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. Center of Watershed Protection. Ellicot City, MD.

SOP 312 – YSI Model 85 Multi-parameter Meter – Operation, Calibration and Maintenance

Dissolved Oxygen (DO), conductivity, and temperature measurements are collected from water samples using YSI Model 85 Multi-parameter Meters. These parameters are often measured in conjunction with other field parameters (pH and temperature) when manually collecting "grab" water samples. Meters need to be properly maintained and calibrated to ensure accurate measurements while in the field.

Application:

This standard operating procedure (SOP) is intended for stormwater personnel who are responsible for taking field measurements of DO and conductivity, typically in conjunction with collecting manual grab samples. SOP 110 will be followed to obtain a field parameter grab sample.

Ada County Highway District currently has YSI Model 85 meters to measure DO and conductivity. The YSI Model 85 Operations Manual is available at

S:\STORMWATER\SW Monitoring Manuals\YSI-Model-85-Operations-Manual-RevE.pdf

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- DO, conductivity and temperature measurements may be performed during all weather conditions, day or night.
- Dress appropriately for weather and traffic conditions.
- Keep work areas lit to reduce accidents and ensure accurate measurements.
- Follow SOP 110 to collect the field parameter sample to be measured.
- Ensure that the correct sampling container is used. Generally, field parameters are taken using a clean, 500 mL amber glass container supplied by the water quality lab.
- Bring an extra sampling container in case of container breakage.
- Ensure that the meter has been properly maintained and calibrated prior to going out to the field.
- Ensure that nitrile gloves are worn during calibration and maintenance procedures.
- Bring extra batteries (6 AAs).

Procedures:

<u>Prior to Sampling Event</u>

1. Check sponge in Calibration/Storage Chamber to make sure it is moist (Figure 1).
2. Turn unit on by pressing down on the On/Off button.
3. Press LIGHT button, to ensure batteries and backlight are functioning.

   Note: The LCD will display a "LO BAT" message when the

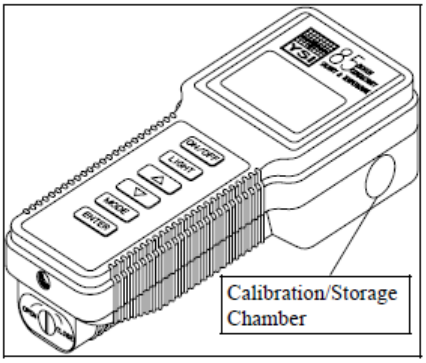

Figure 1. YSI 85

batteries need to be replaced.

4. Inspect membrane cap for damage. Change if necessary.
   Note: For correct probe operation the gold cathode should always be bright. If tarnished it can be cleaned at the factory or a cleaning kit ordered. See manual for details.

Field Sampling

1. Upon arriving on site, open instrument case and turn on instrument by pressing the **ON/OFF** button on the front panel.
2. Press the **MODE** button slowly (allowing the instrument to respond) until dissolved oxygen in mg/L is displayed.
3. Allow the temperature reading to stabilize prior to calibration of DO.
4. Follow steps provided on laminated sheet adhered to inside cover of the instrument case to calibrate the DO probe.
   NOTE: Conductivity calibration is rarely required because of the factory calibration performed. Conductivity calibration will be verified annually.
5. Proceed with grab sample collection according to **SOP 110**.
6. Remove probe from storage on side of meter by pulling the probe in an outward direction away from the meter.
7. Lower the probe into the sample taking care to submerge the probe deep enough to cover the two ports on top of the probe.
   NOTE: The top of the cord where the probe attaches will be partially submerged. Ideally the probe is suspended in the sample and is not touching the sides or bottom of the container.
8. With gentle, slow movements, slightly agitate the probe in a circular direction.
   NOTE: Create enough movement so the sample at the tip of the probe is representative of ambient conditions, but not too much movement that oxygen is added to the sample.
9. The numbers on the display will slowly decrease until a point is reached where the number appears to stabilize before slightly increasing. The display presents measurements to the nearest hundredth. The reading has stabilized when the variability in the hundredths does not change the reading in the tenths.
   NOTE: Stabilization typically takes several minutes.
10. Record the value in mg/L on the data log form with the corresponding temperature.
11. Press the **MODE** button to display conductivity in µS/cm.
12. Record the value in µS/cm and the corresponding temperature on the data log form.
13. Spray and rinse the probe thoroughly with distilled water.
14. Push probe back into the storage chamber on the side of the meter.
15. Push the **ON/OFF** button on the front panel to turn off the meter.
16. Return meter to the instrument case.
17. Secure latches.

Following a Sampling Event

1. Wipe the unit clean using a damp cloth or paper towel.
2. Ensure unit is off, prior to storage

Annually

1. Once a year a calibration should be performed for conductivity. See Section 5.2 of the Instruction Manual.

Prepared by: Monica Lowe, ACHD Stormwater Quality Coordinator_____

Reviewed by: Ted Douglass, Brown and Caldwell, Project Manager _____

SOP 313 - pH Meter – Operation, Calibration and Maintenance

pH Meters are used to record the pH level and temperature during the manual collection of grab samples. pH levels and temperature will generally be recorded in conjunction with other field parameters (dissolved oxygen and conductivity) when manually collecting water samples. pH meters need to be properly maintained and calibrated to ensure accurate measurements while in the field.

Application:

This standard operating procedure (SOP) is intended for stormwater personnel who are responsible for obtaining field parameter measurements in conjunction with collecting manual grab samples. SOP 110 will be followed to obtain a field parameter grab which will be used to measure pH.

Ada County Highway District currently has Horiba D series handheld pH meters. The Horiba Instruction Manual is available at http://www.coleparmer.com/Assets/manual_pdfs/58702-20.pdf or at S:\STORMWATER\SW Monitoring Manuals\HoribaDSeries_pHMeter.pdf

Considerations:

Due to the variable nature of field work, advance planning and preparation is necessary. Consider the following:

- Field pH measurements may be performed during all weather conditions, day or night.
- Dress appropriately for weather and traffic conditions.
- Keep work areas lit to reduce accidents and ensure accurate measurements.
- Follow SOP 110 to collect the field parameter sample to be measured.
- Ensure that the correct sampling container is used. Generally, field parameters are taken using a clean, 500 mL amber glass container supplied by the water quality lab.
- Bring an extra sampling container in case of container breakage.
- Ensure that the meter has been maintained and calibrated prior to going out to the field.
- Ensure that nitrile gloves are worn during calibration and maintenance procedures.
- Bring extra batteries (2AAs).

Procedures:

Prior to Sampling Event

1. Connect electrode and temperature connection to the unit.
2. Thoroughly rinse the electrode with distilled water or reagent water and blot dry with tissue paper.
3. Check to ensure the internal reference solution of the electrode is full. Fill if needed.
   NOTE: This solution is concentrated KCl. Be sure to wear gloves and safety glasses when using this solution.
4. Ensure that the internal solution filler port is open when taking measurements. This port is also where the internal reference solution is filled or removed.

5. Calibrate with standard solutions (pH 4.00, pH 7.00 and pH 10.00) according to the steps outlined in the Instruction Manual.
6. Fill protective cap with fresh distilled water and place electrode in the cap for storage.

Field Sampling

NOTE: If field parameter measurements include dissolved oxygen (DO), as well as pH using the same grab sample, take the DO measurement first to ensure oxygen is not added to the sample by the stirring action called for in Step 7.

1. Open instrument case and turn on instrument by pressing the **ON/OFF** button on the front panel.
   NOTE: A "Y" connector connects the electrode probe and temperature probe to the meter. The electrode probe has a plastic covering that threads onto the meter where the cord and meter connect. The temperature probe has an o-ring that must be securely pressed into the meter to take an accurate temperature reading. Check to make sure the electrodes are securely attached to the meter.
2. Remove probe from plastic storage container by pulling in an outward direction.
3. Set plastic storage container upright in instrument case so the distilled water/storage solution does not spill.
4. Slide open the port on side of the probe.
5. Lower probe into the field parameter grab sample collected according to SOP 110, taking care NOT to submerge the probe too deep. **Do not allow any of the grab sample to enter the open port on the side of the probe.**
6. Gently stir probe in a circular direction taking care NOT to touch the sides or bottom of the sample container.
7. Press the **MEAS** key.
8. **HOLD** will flash in the display.
9. The **HOLD** will stop flashing and remain lit in the display when the value has stabilized.
10. Once **HOLD** remains lit and does not flash, record the pH value and temperature on the data form.
    NOTE: If 25° C is displayed for temperature, double check to ensure the temperature probe and o-ring are securely engaged. 25°C is a default temperature reading generally indicating the temperature probe is not engaged.
11. Slide cover to close port on side of probe.
12. Rinse the probe thoroughly using distilled water.
13. Return probe into plastic storage container.
14. Place probe and meter in instrument case.
15. Secure latches.

Following a Sampling Event

1. Wipe the unit clean using a damp cloth or paper towel.
2. Thoroughly rinse the electrode and protective cap with distilled or deionized water.
3. Disconnect electrode and temperature connection from the unit for storage.

Semi-Annually

1. Replace the internal solution in electrode with fresh 3.33 M KCL solution. Change the internal solution more frequently if calibration is slow.

Soak sponge in the bottom of the protective cap in a dilute chlorox solution, if mold growth occurs.

Prepared by Monica Lowe, ACHD, Stormwater Quality Coordinator_____

Reviewed by Ted Douglass, Brown and Caldwell, Program Manager_____

DOC326.97.00024

Storm Water Test Kit

11/2013, Edition 1

User Manual

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General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.



Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user.
Note: *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*

Product overview

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Environmental Protection Agency (EPA) studies show that storm water runoff carries pollutants to nearby lakes, rivers and streams. To protect receiving waters, the EPA issued regulations* in November 1990 which apply to both municipalities and industrial storm water discharges.

Part 1 of the NPDES (National Pollutant Discharge Elimination System) application requires municipalities to do field screening with grab samples collected from dry weather flows. These samples will be analyzed for pH, total chlorine, total phenols, total copper and detergents.

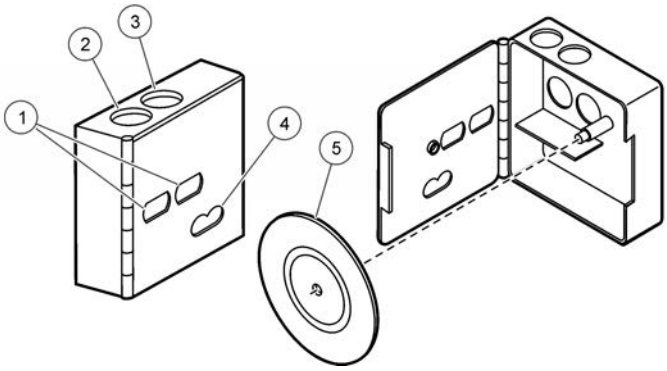
Use this test kit on-site or in a laboratory to identify the pH level and the concentrations of total chlorine, total phenols, total copper and detergents in storm sewer outflow and industrial discharge. Refer to Table 1 for the test kit parameters.

A color comparator box and color discs are used to identify the concentration of total chlorine, total phenols, total copper and detergents. Refer to Figure 1. The Pocket Pro pH tester is used to identify the pH level.

Table 1 Test kit parameters

Parameter	Range	Number of tests	Type of test	Sensitivity
pH	0–14	Refer to packaging	Ion selective electrode	Refer to packaging
Chlorine, total	0–3.4 mg/L	100	DPD	0.1 mg/L
Copper, free and total	0–4 mg/L	100	Bicinchoninate Hydrosulfite reduction	0.1 mg/L
Phenol	0–4	100	4-aminoantipyrine	0.1 mg/L
Detergents	0–1.2 mg/L	32	Toluidine Blue-O	0.05 mg/L

Figure 1 Color comparator box



1 Color matching windows	**4** Scale window
2 Opening for tube with untreated sample	**5** Color disc
3 Opening for tube with prepared sample	

* Federal Register, November 16, 1990.

Product components

Make sure that all components have been received. Refer to the list that follows. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

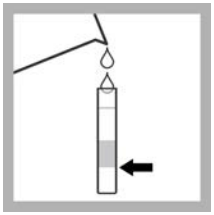
- Pocket Pro™ pH tester
- Color discs (4x)
- Color viewing tubes with caps (4x)
- Color comparator box
- Carrying case
- Chloroform, ACS grade
- Detergents Test Solution
- Wash Water Buffer (2x)
- Hardness 1 Buffer Solution
- Filtering thimble
- Test tube, 10-mL (2x)
- Draw-off pipet
- Stopper for color viewing tubes
- Phenol Reagent Powder Pillows
- Hydrosulfite Reagent Powder Pillows
- Free Copper Reagent Powder Pillows
- EDTA Reagent Powder Pillows
- DPD Total Chlorine Reagent Powder Pillows
- Potassium Persulfate Powder Pillows
- pH 7.0 SINGLET™ buffer solution packs
- Dropper
- Beaker, 100-mL
- Demineralizer bottle
- Glass wool for detergents test

Total Chlorine

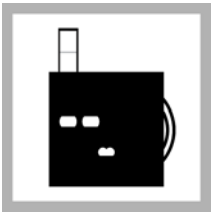
Test preparation

- Assemble the color comparator. Put the DPD Chlorine color disc on the center pin with the lettering facing out.
- Use sunlight or a fluorescent light source to compare colors.
- Rinse all viewing tubes with the sample water before testing and between tests.
- Accuracy is not affected by undissolved powder.
- If the disc becomes wet, carefully open the plastic case. Dry the case and the color insert with a soft cloth. Assemble the case when the parts are completely dry.

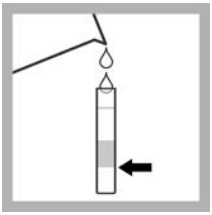
Total Chlorine (0–3.4 mg/L) test procedure



1. Fill one color viewing tube to the lower edge of the frosted area (5-mL mark) with clear water.



2. Put the tube into the left opening on the top of the comparator.



3. Fill a second color viewing tube to the lower edge of the frosted area (5-mL mark) with the water sample.



4. Add the contents of one DPD Total Chlorine Reagent Powder Pillow.



5. Swirl to mix.



6. A color will develop if chlorine is present in the sample. Wait 3–6 minutes for full color development.



7. Put the tube into the right opening on the top of the comparator. Hold the comparator in front of a light source. Turn the disc to find a color match.



8. Read the mg/L total chlorine (Cl_2) from the scale window. If the result is between two values, use the value halfway between the two printed numbers.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Color comparator box	1	173200
Color viewing tubes with caps	4/pkg	4660004
DPD Chlorine disc, 0–3.4 mg/L	1	990200

Description	Unit	Item no.
DPD Total Chlorine Reagent Powder Pillows	100/pkg	1407699
Caps for color viewing tubes	4/pkg	4660014

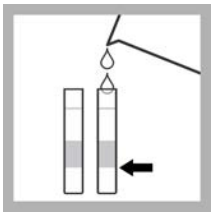
Total Copper

Test preparation

This test procedure identifies the concentration of free or complexed copper. Free copper refers to any free or weakly chelated copper ion in solution. Complexed (chelated) copper is tightly bound, as in Cu (EDTA). Free copper plus complexed copper gives the total dissolved copper.

- Assemble the color comparator. Put the copper color disc on the center pin with the lettering facing out.
- Use sunlight or a fluorescent light source to compare colors.
- Rinse all viewing tubes with the sample water before testing and between tests.
- Accuracy is not affected by undissolved powder.
- Refer to Table 2 on page 9 for interfering substances.
- If the disc becomes wet, carefully open the plastic case. Dry the case and the color insert with a soft cloth. Assemble the case when the parts are completely dry.

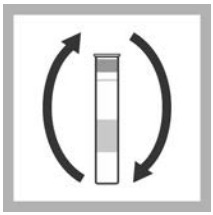
Free and Total Copper (0-4 mg/L) test procedure



1. Fill two color viewing tubes to the lower edge of the frosted area (5-mL mark) with the water sample.



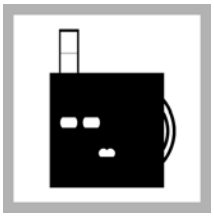
2. Add the contents of one Free Copper Reagent Powder Pillow to one of the tubes.



3. Put a stopper in the tube with the powder. Invert the tube several times to mix.



4. A purple color will develop if free copper is present in the sample. Wait 2 minutes for full color development.



5. Put the untreated sample tube into the left opening on the top of the comparator.



6. Put the prepared sample tube into the right opening on the top of the comparator. Hold the comparator in front of a light source. Turn the disc to find a color match.



7. Read the mg/L free copper (Cu) from the scale window. If the result is between two values, use the value halfway between the two printed numbers.



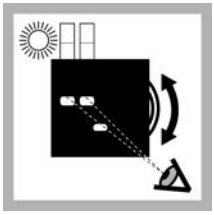
8. To identify the concentration of total dissolved copper present, add the contents of one Hydrosulfite Reagent Powder Pillow (clear pillow) to the tube.



9. Put a stopper in the tube. Remove the tube from the comparator. Invert the tube several times to mix.



10. Wait 2 minutes for full color development.



11. Put the prepared sample tube back into the right opening on the top of the comparator. Hold the comparator in front of a light source. Turn the disc to find a color match.



12. Read the mg/L total dissolved copper (free copper and complexed copper) from the scale window. If the result is between two values, use the value halfway between the two printed numbers.



13. To identify the concentration of complexed copper present in the sample, subtract the amount of free copper from the amount of total dissolved copper.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Cyanide	More than 2 mg/L inhibits color development Add three drops of Formaldehyde Solution before the viewing tube is put into the comparator box. Wait 3 minutes and then read the mg/L free copper.

Accuracy check

Periodically identify the reagent accuracy with a reliable standard such as Copper Standard Solution 10-mg/L.

1. Prepare a 2 mg/L free copper solution.
   a. Carefully measure 1 mL of Copper Standard Solution 10-mg/L into a sample tube.
   b. Add deionized water to the sample tube to the 5 mL mark.
2. Identify the concentration of copper that is present in the standard. Refer to Free and Total Copper (0-4 mg/L) test procedure on page 8.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Unit	Item no.
Color comparator box	1	173200
Color viewing tubes with caps	6/pkg	173006
Copper color disc	1	9263300
Free Copper Reagent Powder Pillow	100/pkg	2182369
Hydrosulfite Reagent Powder Pillow	100/pkg	2118869
Stoppers for viewing tubes	6/pkg	173106

Optional items

Description	Unit	Item no.
Copper Standard Solution 10 mg/L	100 mL MDB	12932
Formaldehyde Solution	100 mL SCBD	205932

Detergents

Test preparation

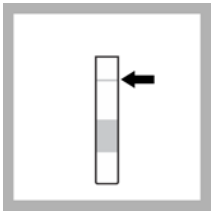
- Assemble the color comparator. Put the Detergents color disc on the center pin with the lettering facing out.
- Use sunlight or a fluorescent light source to compare colors.
- Rinse all viewing tubes with the sample water before testing and between tests.
- If the disc becomes wet, carefully open the plastic case. Dry the case and the color insert with a soft cloth. Assemble the case when the parts are completely dry.

Filter the chloroform layer

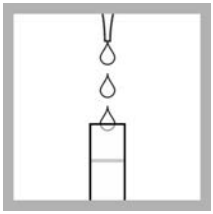
If the water sample is turbid, filter the chloroform layer at step 13.

1. Put a small ball (about the size of a large pea) of glass wool in the filter thimble.
2. Use the draw-off pipet to remove the chloroform. Filter the chloroform through the glass wool and into an unused, glass test tube.

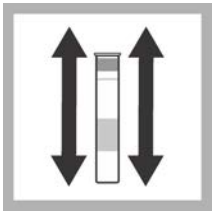
Detergents (0–1.2 mg/L) test procedure



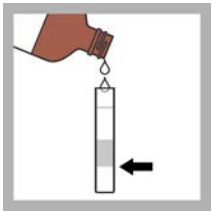
1. Fill one test tube to the upper mark (20 mL) with the water sample.



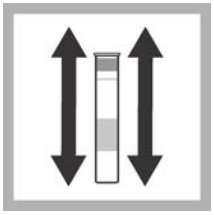
2. Add 12 drops of Detergent Test Solution.



3. Put the stopper in the tube. Shake to mix.



4. Add chloroform to the lowest mark (5 mL). Chloroform is heavier than water and will go to the bottom of the tube.



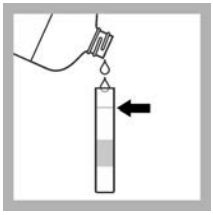
5. Put the stopper in the tube. Shake vigorously for 30 seconds.



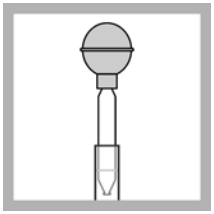
6. Do not touch the tube for 1 minute to let the chloroform separate.



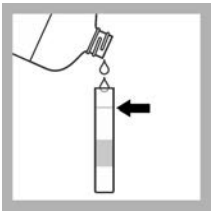
7. Use the draw-off pipet to remove the water from the tube. Discard the water.



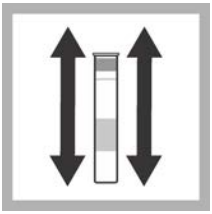
8. Add Wash Water Buffer to the upper mark (20 mL).



9. Use the draw-off pipet to remove the Wash Water Buffer. Discard the buffer.
Note: *This step washes away the remaining water sample.*



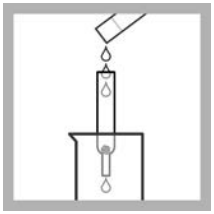
10. Add Wash Water Buffer to the upper mark (20 mL).



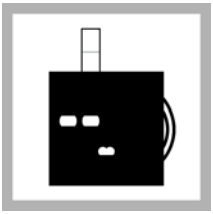
11. Put the stopper in the tube. Shake vigorously for 30 seconds.



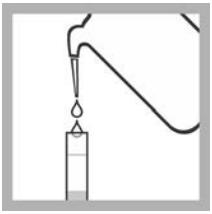
12. Do not touch the tube for 1 minute to let the chloroform separate.



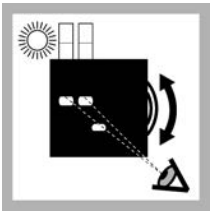
13. If the water sample is turbid, filter the chloroform layer.



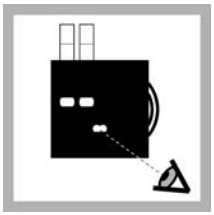
14. Put the prepared sample tube into the right opening on the top of the comparator.



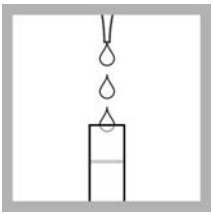
15. Fill a second test tube with deionized water.



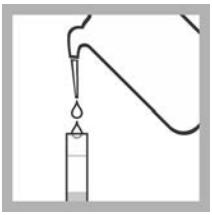
16. Put the deionized water tube into the left opening on the top of the comparator. Hold the comparator in front of a light source. Turn the disc to find a color match.



17. Read the ppm Detergents (LAS and/or ABS) from the scale window. If the result is between two values, use the value halfway between the two printed numbers. If the color is darker than the highest reading on the color disc, do steps 18–20 to make a 20-to-1 dilution.



18. Discard the contents of the prepared sample tube (in the right opening). Rinse the tube with deionized water. Use the dropper to add 1 mL of the water sample to the tube.



19. Add deionized water to the upper mark (20 mL).



20. Do steps 2–17 and multiply the results by 20.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Quantity	Item no.
Bulb for draw-off pipette	1	178600
Color comparator box	1	173200
Color viewing tubes with caps, 5 mL and 20 mL marks	6/pkg	173606
Chloroform, ACS grade (approximately 100 tests)	500 mL	1445849
Detergents color disc, 0–1.2 mg/L	1	9265700
Detergents reagent	100 mL MDB	105932
Dropper, 0.5 mL and 1.0 mL marks	5/pkg	1419700
Filtering thimble	1	51200
Glass tube for draw-off pipette	1	221800
Glass wool	5 g	252074
Test tube	10/pkg	56510
Wash Water Buffer (approximately 32 tests)	500 mL	99949

pH

Refer to the documentation supplied with the Pocket Pro™ pH tester to do a pH measurement.

Phenols

Test preparation

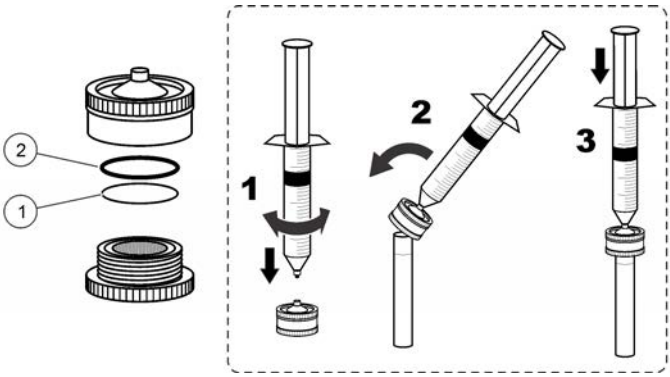
- Assemble the color comparator. Put the Phenols color disc on the center pin with the lettering facing out.
- Use sunlight or a fluorescent light source to compare colors.
- Rinse all viewing tubes with the sample water before testing and between tests.
- If the disc becomes wet, carefully open the plastic case. Dry the case and the color insert with a soft cloth. Assemble the case when the parts are completely dry.

Filter the sample

If the sample is turbid, it may be necessary to filter the sample.

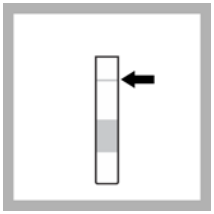
1. Install a 0.45 micron filter disc in the filter holder. Refer to Figure 2. Make sure that the holder is closed tight after the disc is installed.
2. Fill the 30-cc syringe with the turbid sample.
3. Attach the filter holder to the syringe with a twisting motion.
4. Filter the sample directly into the viewing tubes from the syringe. Use the filtered sample in the test procedure.

Figure 2 Assemble the filter assembly



1 Filter disc	**2** O-ring

Phenols (0–4 mg/L) test procedure



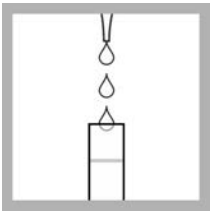
1. Fill two color viewing tubes to the upper mark (20 mL) with water sample.



2. Add the contents of one EDTA Reagent Powder Pillow to each tube.



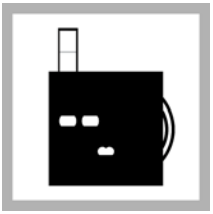
3. Put the cap on each tube and swirl until the powder is dissolved.



4. Add 15 drops of Hardness 1 Buffer Solution to each tube.



5. Put the cap on each tube and swirl.



6. Put one of the tubes into the left opening on the top of the comparator.



7. Add the contents of one Phenol Reagent Powder Pillow for non-extraction method to the second tube.



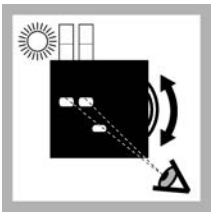
8. Put the cap on the tube and swirl until the powder is dissolved.



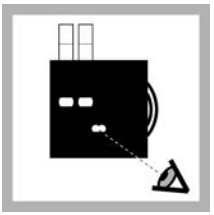
9. Add the contents of one Potassium Persulfate Powder Pillow for Phosphonate to the second tube.



10. Put the cap on the tube and swirl until the powder is dissolved.



11. Put the second tube into the right opening on the top of the comparator. Hold the comparator in front of a light source. Turn the disc to find a color match.



12. Read the result in mg/L from the scale window. If the result is between two values, use the value halfway between the two printed numbers.

Replacement items

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Quantity	Item no.
Color comparator box	1	173200
Color viewing tubes	4/pkg	4660004

Description	Quantity	Item no.
Clippers for powder pillows	1	93600
EDTA Reagent Powder Pillows	50/pkg	700599
Hardness 1 Buffer Solution	50 mL	42426
Phenol Reagent Powder Pillows (nonextraction)	100/pkg	2481569
Potassium Persulfate Powder Pillows for Phosphonate	100/pkg	2084769

Optional items

Description	Quantity	Item no.
Filter discs, 25 mm, 45 micron	25/pkg	2209525
Filter holder for Luer-Lok	1	246800
Syringe, 30 cc, Luer-Lok tip	1	2225800

Reference Manual

Honeywell



PHD6™ Gas Detector

⚠WARNING

PHD6 PERSONAL PORTABLE GAS DETECTORS HAVE BEEN DESIGNED FOR THE DETECTION AND MEASUREMENT OF POTENTIALLY HAZARDOUS ATMOSPHERIC CONDITIONS

IN ORDER TO ASSURE THAT THE USER IS PROPERLY WARNED OF POTENTIALLY DANGEROUS ATMOSPHERIC CONDITIONS, IT IS ESSENTIAL THAT THE INSTRUCTIONS IN THIS REFERENCE MANUAL BE READ, FULLY UNDERSTOOD, AND FOLLOWED.

PHD6™
Reference Manual
Part Number 13-322
Version 3
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by
Honeywell Inc.
Lincolnshire, Illinois 60069

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Certification Information

The PHD6 carries the following certifications:

QPS Class I Division 1 Groups A,B,C,D Temp Code T3C (Approved to UL 913)
QPS USTC Class II Division 1 Groups E,F,G (Approved to UL 913)
QPS USTC Class III (Approved to UL 913)

CSA Class I, Division 1 Groups A,B,C,D Temp Code T3C
ONLY THE COMBUSTIBLE GAS DETECTION PORTION OF THIS INSTRUMENT HAS BEEN ASSESSED FOR PERFORMANCE.

ATEX: Ex d ia IIC 170 °C (T3)
IECEx: Ex d ia IIC 170 °C (T3)
CE Mark

Operating Temperature and Humidity Limits

⚠WARNING The PHD6's operating temperature range is printed on the label on the back of the instrument. Use of Honeywell Gas Detectors outside of the instrument's specified operating temperature range may result in inaccurate and potentially dangerous readings.

Signal Words

The following signal words, as defined by ANSI Z535.4-1998, are used in the PHD6 Reference Manual.

⚠DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION indicates a potentially hazardous situation, which if not avoided, may result in moderate or minor injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Warnings and Cautions

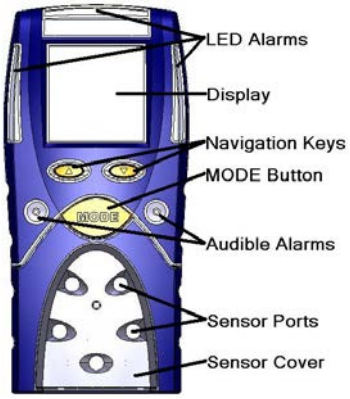
1. **⚠WARNING The PHD6 personal, portable gas detector has been designed for the detection of dangerous atmospheric conditions. An alarm condition indicates the presence of a potentially life-threatening hazard and should be taken very seriously. Failure to immediately leave the area may result in serious injury or death.**
2. **⚠WARNING In the event of an alarm condition it is important to follow established procedures. The safest course of action is to immediately leave the affected area, and to return only after further testing determines that the area is once again safe for entry. Failure to immediately leave the area may result in serious injury or death.**
3. **⚠WARNING The PHD6 must be located in a non-hazardous location whenever alkaline batteries are removed from the alkaline battery pack. Removal of the alkaline batteries from the battery pack in a hazardous area may impair intrinsic safety.**
4. **⚠WARNING Use only Duracell MN1500 or Ultra MX1500, Eveready Energizer E91-LR6, Eveready EN91 batteries in the alkaline battery pack. Substitution of batteries may impair intrinsic safety.**
5. **⚠WARNING To reduce the risk of explosion, do not mix old or used batteries with new batteries and do not mix batteries from different manufacturers.**
6. **⚠WARNING Do not charge the PHD6 with any charger other than the appropriate PHD6 charger. Standard versions of the PHD6 must be charged with the UL/CSA-approved charger, which is part number 54-49-103-1. European versions of the PHD6 must be charged with the ATEX-approved charger, which is part number 54-49-103-5.**
7. **⚠WARNING The PHD6 must be located in a non-hazardous location during the charging cycle. Charging the PHD6 in a hazardous location may impair intrinsic safety.**
8. **⚠WARNING PHD6 rechargeable battery packs are supplied with Panasonic CGR18650D Lithium-Ion batteries. The Li-Ion batteries in the battery packs may not be replaced by the user. The rechargeable pack must be obtained from Honeywell and replaced as a complete assembly to maintain intrinsic safety.**
9. **⚠WARNING The accuracy of the PHD6 should be checked periodically with known concentration calibration gas. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.**

(The Canadian Standards Association (CSA) requires an accuracy check using known concentration calibration gas prior to each day's use.)

10. **⚠WARNING Fresh air/zero calibrations may only be performed in an atmosphere that is known to contain 20.9% oxygen, 0.0% LEL and 0 PPM toxic gas.**
11. **⚠WARNING The accuracy of the PHD6 should be checked immediately following any known exposure to contaminants by testing with known concentration test gas before further use. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.**
12. **⚠WARNING A sensor that cannot be calibrated or is found to be out of tolerance should be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.**
13. **⚠WARNING Do not reset the calibration gas concentration unless you are using a calibration gas concentration that differs from the one that is normally supplied by Honeywell for use in calibrating the PHD6.**
    Customers are strongly urged to use only Honeywell calibration materials when calibrating the PHD6. Use of non-standard calibration gas and/or calibration kit components can lead to dangerously inaccurate readings and may void the standard Honeywell warranty.
14. **⚠WARNING Use of non-standard calibration gas and/or calibration kit components when calibrating the PHD6 can lead to inaccurate and potentially dangerous readings and may void the standard Honeywell warranty.**
    Honeywell offers calibration kits and long-lasting cylinders of test gas specifically developed for easy PHD6 calibration. Customers are strongly urged to use only Honeywell calibration materials when calibrating the PHD6.
15. **⚠WARNING Substitution of components may impair intrinsic safety.**
16. **⚠WARNING For safety reasons this equipment must be operated and serviced by qualified personnel only. Read and understand this reference manual before operating or servicing the PHD6.**
17. **⚠WARNING A rapid up-scale reading followed by a declining or erratic reading may indicate a hazardous combustible gas concentration that exceeds the PHD6's zero to 100 percent LEL detection range.**
18. **⚠WARNING The PHD6 is not designed for use in oxygen enriched atmospheres.**
19. **⚠WARNING Do not use the PHD6 pump for prolonged periods in an atmosphere containing a concentration of solvent or fuel that may be greater than 50% LEL.**
20. **⚠WARNING Do not unplug the NDIR-CH^4 or NDIR-CO^2 sensors in an explosive atmosphere. Unplugging IR sensors in an explosive atmosphere may impair intrinsic safety.**

1. Description

The PHD6 is a multi-sensor gas detector that can be configured to meet a wide variety of user requirements. This chapter provides an overview of many of the features of the PHD6. More detailed descriptions of the specific features of the PHD6 are contained in the subsequent chapters of this manual.



1.1 Methods of sampling

The PHD6 may be used in either diffusion or sample-draw mode. In either mode, the gas sample must reach the sensors for the instrument to register a gas reading. The sensors are located at the lower front of the instrument.

⚠WARNING The sensor ports must be kept free of obstruction. Blocked sensor ports can lead to inaccurate and potentially dangerous readings.

In diffusion mode, the atmosphere being measured reaches the sensors by diffusing through the sensor ports at the front of the instrument. Normal air movements are enough to carry the sample to the sensors. The sensors react quickly to changes in the concentrations of the gases being measured. Diffusion-style operation monitors only the atmosphere that immediately surrounds the detector.

The PHD6 can also be used to sample remote locations with its hand-aspirated sample-draw kit or with its motorized, continuous sample draw pump. During remote sampling, the gas sample is drawn into the sensor compartment through the probe assembly and a length of tubing. Remote sampling operations only monitor the atmosphere at the end of the sample draw probe.

Use of the hand-aspirated sample draw kits is covered in section 3.1.

Use of the motorized sample draw pump is covered in section 3.2.

A detailed description of the PHD6 probe assembly is given in section 6.5

1.2 Multi-sensor capability

The PHD6 can be configured to simultaneously monitor oxygen, combustible gases and vapors, volatile organic compounds (VOCs), and a wide variety of toxic gases. All sensors are replaceable in the field.

Note: The accuracy of the PHD6 must be verified by calibration with known concentration test gas whenever a change is made to the sensors installed in the instrument.

Calibration procedures are discussed in detail in Chapter 4.

The PHD6 can utilize a variety of sensor types to detect atmospheric contaminants including electrochemical sensors, PID (Photo Ionization Detector) sensors, NDIR (Non-Dispersive Infra-Red Absorbance) sensors and catalytic hot-bead LEL sensors.

Different measurement units are used depending on the gas being measured.

Type of Hazard	Measurement unit
Oxygen (O_2)	Percentage by volume
Combustible gas (LEL Sensor)	Percentage of lower explosive limit (%LEL) or %/Vol CH_4
Hydrocarbon-specific combustible gas sensor (NDIR – CH_4)	Percentage of lower explosive limit (%LEL) or %/Vol CH_4
Volatile Organic Compounds (VOCs) (PID Sensor)	Parts-per-million (PPM) or tenths of a part-per-million (0.1PPM)
Toxic Gases (by electrochemical sensor	Parts-per-million (PPM) – some sensors capable of tenths of a part-per-million (0.1PPM)
Toxic Gas by NDIR – CO_2 sensor	%/Vol CO_2

Table 1.2. PHD6 Units of Measurement.

1.3 Calibration

The PHD6 detector features fully automatic fresh air and gas calibration.

⚠WARNING The accuracy of the PHD6 should be checked periodically with known concentration calibration gas. Failure to check accuracy can lead to inaccurate and potentially dangerous readings. (The Canadian Standards Association (CSA) requires an accuracy check using known concentration calibration gas prior to each day's use.)

Calibration procedures are discussed in detail in Chapter 4.

Recommended calibration frequency is discussed in Appendix B.

1.4 Alarm logic

PHD6 gas alarms can be adjusted manually using the PHD6's built in menu functions, with BioTrak II software via IrDA interface, or with the IQ Database Manager Program through the IQ6 Dock. (See Chapter 6 for direct menu programming instructions). Alarms may be set anywhere within the nominal range of the specific sensor. When an alarm set point is exceeded a loud audible alarm sounds, and the bright red LED alarm lights flash.

1.4.1 Atmospheric hazard alarms

⚠WARNING PHD6 portable gas detectors have been designed for the detection of deficiencies of oxygen, accumulations of flammable gases and vapors, and accumulations of specific toxic gases. An alarm condition indicating the presence of one or more of these potentially life-threatening hazards should be taken very seriously. Failure to immediately leave the area may result in serious injury or death.

⚠WARNING In the event of an alarm condition it is important to follow established procedures. The safest course of action is to immediately leave the affected area, and to return only after further testing determines that the area is once again safe for entry. Failure to immediately leave the area may result in serious injury or death.

⚠WARNING A rapid up-scale reading followed by a declining or erratic reading may indicate a hazardous combustible gas concentration that exceeds the PHD6's zero to 100 percent LEL detection range. Failure to immediately leave the area may result in serious injury or death.

The combustible gas alarms are activated when the reading for combustible gases exceeds one of the alarm setpoints. Combustible gas readings are typically given in terms of percent of LEL (Lower Explosive Limit), but may also be shown in terms of percent-by-volume methane (CH_4). The PHD6 includes Warning and Danger alarms for the both the LEL sensor and the NDIR-CH_4 sensor.

Two oxygen alarm set points have been provided; a low alarm for oxygen deficiency and a high alarm for oxygen enrichment.

Up to four alarm set points are provided for the PID sensor and for each toxic gas sensor: Warning, Danger, STEL (Short Term Exposure Limit) and TWA (Time Weighted Average).

Appendix A discusses Warning, Danger, STEL and TWA alarms.

1.4.2 Low battery alarms

The PHD6 includes multi-staged alarms for both the Li-Ion and alkaline battery packs to let the user know that the battery is running low.

For detailed information concerning the low battery alarms, see section 2.5.5.

⚠WARNING Use only Duracell MN1500 or Ultra MX1500, Eveready Energizer E91-LR6, Eveready EN91 batteries. Substitution of batteries may impair intrinsic safety.

1.4.3 Sensor over range alarms

The PHD6 will go into alarm if a sensor is exposed to a concentration of gas that exceeds its established range. In the case of an LEL or NDIR-CH_4 sensor reading that exceeds 100% LEL, the sensor channel will be automatically disabled by the instrument and the instrument will remain in constant alarm until it is turned off, brought to an area that is known to be safe, and then turned back on. The display will show a vertical arrow with two heads in place of the sensor reading for any channel that has gone into over range alarm.

See section 2.5.2 for further details.

⚠WARNING In the event of an LEL overrange alarm the PHD6 must be turned off, brought to an area that is known to be safe and then turned on again to reset the alarm.

1.4.4 PID lamp out alarm

The PHD6 monitors the status of the PID lamp to ensure that it is functioning properly. Alarms are generated if the PHD6 determines that the lamp is out. See section 2.5.3 for further details

1.4.5 LEL response failure due to lack of O_2 alarm

The PHD6 features automatic warning against LEL sensor response failure due to lack of oxygen. See section 2.5.4 for details.

1.4.6 Security beep/flash

The PHD6 includes a security beep function that is designed to notify the user that the instrument is powered up and running. Once enabled the PHD6 will emit a short audible beep and give a short flash on the LED at a user-defined interval.

The security beep/flash can be enabled manually through the Main Menu (see chapter 5), with BioTrak II software or through the IQ6 Dock.

1.4.7 Latching alarms

The PHD6's alarms are self-resetting unless the alarm latch is enabled. With the PHD6's alarm latch enabled, the audible and visible alarms will continue to sound after the atmospheric hazard has cleared. To reset the alarms, simply press the MODE button. If the alarm latch is disabled and the alarm condition is no longer present, the instrument will automatically return to normal operation, and the visible and audible alarms cease without further input from the user.

Latching alarms can be enabled manually through the Main Menu (see chapter 5), with BioTrak II software or through the IQ6 Dock.

1.4.8 Fault detection

PHD6 software includes a number of additional alarms designed to ensure the proper operation of the instrument. When the PHD6 detects that an electronic fault or failure condition has occurred, the proper audible and visible alarms are activated and an explanatory message is displayed.

Faults and other electronic safeguards are discussed in detail in section 2.5.

⚠WARNING The PHD6 is designed to detect potentially life threatening atmospheric conditions. Any alarm condition should be taken seriously. The safest course of action is to immediately leave the affected area, and return only after further testing determines that the area is once again safe for entry.

1.5 Other electronic safeguards

Several automatic programs prevent tampering and misuse of the PHD6 by unauthorized persons. Each time the detector is turned on, the PHD6 automatically tests the LED alarm lights, audible alarm, internal memory and pump status (if so equipped). The battery is monitored continuously for proper voltage. The PHD6 also monitors the connection of sensors that are currently installed. The detection of any electronic faults causes the activation of the audible and visible alarms and causes the display of the appropriate explanatory message.

1.6 Sensors

The PHD6 can be configured to simultaneously monitor oxygen, combustible gases and vapors, volatile organic compounds (VOCs) and a number of toxic gases. The sensor configuration of the PHD6 may be specified at the time of purchase, or changed in the field by appropriately trained personnel.

The PHD6 must be calibrated following any sensor replacement.

Replacement sensor part numbers and sensor ranges are given in Appendix C.

⚠WARNING A sensor that cannot be calibrated or is found to be out of tolerance must be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.

Calibration procedures are discussed in detail in Chapter 4.

1.6.1 Cross Sensitivity

Sensor cross-sensitivity figures are given in Appendix D.

The CO channel in the Duo-Tox sensor in the PHD6 may exhibit high levels of cross sensitivity to organic vapors (VOCs). For best performance in an atmosphere known to contain VOCs, use a dedicated CO sensor.

1.7 Optional sample draw pump

A motorized sample-draw pump is available for the PHD6 for situations requiring continuous "hands free" remote monitoring.

⚠WARNING The PHD6 continuous sample draw pump (part number 54-54-102) is the only pump that can be used with the PHD6.

The pump contains a pressure sensor that detects restrictions in airflow caused by water or other obstructions being drawn into the unit and immediately acts to turn the pump off in order to protect the sensors, pump, and other PHD6 components from damage.

Pump status is continuously monitored by the PHD6 microcontroller. When the pump is active and functioning properly, the spinning pump icon is displayed in the status bar at the bottom of the display. Low flow or other pump fault conditions activate audible and visible alarms and cause the display of the appropriate explanatory message.

1.7.1 Special precautions when using the PHD6 pump

The rubber material used in the PHD6 diaphragm pump is susceptible to temporary compromise by exposure to high levels of flammable fuel and solvent vapors. If the PHD6 is being used to sample atmospheres that exceed 50% LEL, test the pump frequently to ensure that pump function has not been compromised.

To test the pump, block the end of the sampling line (probe) inlet with a finger. The pump should quickly go into alarm, which indicates proper function. If the pump fails to go into alarm while the inlet is blocked, it is not working properly; and the PHD6 may not be providing an accurate reading. If the pump test fails, the safest course of action is to immediately leave the affected area and to return only after further testing with known, functional detection equipment confirms that the area is once again safe for entry.

⚠WARNING Do not use the pump to sample for prolonged periods in conditions where the concentration of solvent or fuel vapors may be greater than 50% LEL.

1.8 Data storage

The PHD6 includes a black box data recorder and an event logger as standard features. A full datalogger is available as an upgrade at any time.

1.8.1 Black box data recorder

A black box data recorder is a standard feature in the PHD6. The “black box” is continually in operation whether the user is aware of it or not. The black box stores important information such as gas readings, turn-on times, turn-off times, temperatures, battery conditions, the most recent calibration date and settings, types of sensors currently installed, sensor serial numbers, warranty expiration and service due dates, and current alarm settings.

There is a finite amount of memory storage available in the black box data recorder. Once the memory is “full”, the PHD6 will begin to write the new data over the oldest data. The black box data recorder will store a minimum of 63 hours of data in one-minute increments before it begins to write new data over the oldest data. In this way, the newest data is always conserved.

To extract the information from the black box data recorder, the PHD6 must be returned to Honeywell. Once the data is downloaded from the instrument, a report will be generated. The unit and the report will then be returned to the user. Simply call Honeywells’ Instrument Service Department to obtain a return authorization number. There is no charge for the downloading service, but the user is responsible for any freight charges incurred.

The “black box” data recorder in the PHD6 can be upgraded to a fully enabled datalogger at any time. All that is required is the activation code that corresponds to the serial number of the PHD6 and the PHD6 Upgrade Utility Program.

1.8.2 Event logger

The event logger in the PHD6 stores data associated with alarm conditions. Each (alarm) event includes the following data for each of the installed sensors:

- Sensor type
- Max reading
- Average reading
- Start time
- End time
- Duration of the event.

The PHD6 stores the data from the 20 most recent alarm events. Once 20 events have been stored, the PHD6 will begin to systematically overwrite the data from the oldest event in memory with data from new events. One event may be a combination of different alarms occurring simultaneously or in immediate succession. The event logger may be downloaded using BioTrak II software. The PC must be equipped with IrDA to provide a connection.

1.9 PHD6 design components

1. **Case:** The instrument is enclosed in a solid PC (polycarbonate) case with TPE (rubber) overmold.

2. **Front face:** The front face of the instrument houses the MODE button, navigation keys, LCD (liquid crystal display), LED alarm lights, and audible alarm ports.
3. **Display:** A liquid crystal display (LCD) shows readings, messages, and other information.
4. **Alarm LEDs:** Top, front and side-mounted LED (light emitting diode) alarm lights provide a visual indication of alarm state.
5. **Infrared Port:** The infrared port is located at the bottom of the instrument and is used for communication between the PHD6 and a PC.
6. **On / Off "MODE" button:** The large black push-button on the front of the instrument is the "MODE" button. The MODE button is used to turn the PHD6 on and off as well as to control most other operations, including the initiation of the automatic calibration adjustment.
7. **Navigation Keys:** The up and down navigation keys are located between the MODE button and the display.
8. **Sensor compartment cover:** The sensors are located in a vented compartment at the bottom of the instrument.
9. **Audible alarm ports:** Two cylindrical ports extending through the front of the instrument on opposing sides of the MODE button house the loud audible alarms. The waterproof audible alarms seat directly to the rubber inner-liner to protect the instrument against leakage or exposure to liquids.
10. **Battery pack:** Two types of interchangeable battery packs (rechargeable Lithium Ion (Li-Ion) and disposable alkaline) are available for use. Li-Ion battery packs are recharged with the pack installed on the PHD6.
11. **Battery charger connector:** A water-resistant connector at the bottom of the case assembly is used to connect the PHD6 to the “drop in” style charger.
12. **Battery Compartment / Clip:** The battery inserts from the back of the instrument. A sturdy clip attached to the battery allows the user to wear the PHD6 on a belt or other article of clothing.

1.10 PHD6 standard accessories

Standard accessories included with every PHD6 include calibration adapter, additional tubing for use during calibration, manual sample draw kit, reference manual and quick reference card. The manual sample draw kit consists of a sample draw / calibration adapter, squeeze bulb, replacement sample probe filters, ten feet/three meters of tubing and a sample probe.

Standard configurations of the PHD6 are delivered in a cardboard box with cardboard inserts.

1.10.1 Alkaline PHD6 detectors

If the PHD6 has been purchased as an alkaline instrument, the standard accessories include an alkaline battery pack and a set of 3 disposable AA alkaline batteries.

1.10.2 Li-Ion PHD6 detectors

If the PHD6 has been purchased as a Li-Ion rechargeable instrument, the standard accessories include Li-Ion battery pack and a slip-in PHD6 charger.

1.11 PHD6 kits

PHD6 detectors may also be purchased as part of a complete kit that includes calibration gas, fixed-flow regulator and a hard-shell carrying case.

1.11.1 PHD6 Confined Space Kits

In addition to the standard accessories listed above, Confined Space Kits also include calibration fittings, fixed-flow regulator with pressure gauge, and appropriate large cylinder(s) of calibration gas in a foam-lined, waterproof hard-shell carrying case.

1.11.2 PHD6 Value Packs

PHD6 Value Packs include an alkaline PHD6, all standard accessories, calibration fittings, small cylinder of calibration gas, and fixed flow regulator in a foam-lined non-waterproof hard-shell carrying case.

2. Basic Operations

The PHD6 is a three-button gas detector. Most day-to-day functions are initiated solely with the MODE button. The MODE button controls:

- Turning the PHD6 on and off
- Turning on the backlight
- Viewing the MAX, STEL and TWA reading screens
- Initiating the calibration sequence

2.1 Turning the PHD6 On

To turn the PHD6 on, press and hold the MODE button for one second. The introduction screen is followed by a screen showing a list of installed sensors and the sensor ports they occupy. The PHD6 has 5 sensor ports, but can display readings for as many as 6 distinct gases.



The serial number will then be shown. If the detector has a fully enabled datalogger, the interval and memory capacity will be shown.

The sampling interval is given in minutes and seconds. The datalogger samples continuously, so the data stream must be broken into intervals to be recorded. The datalogging interval defines the frequency of the breaks in the data stream. The capacity is the number of hours and minutes it will take to completely fill the datalogger’s memory. Once the memory is filled, the PHD6 will start to write new data over the oldest data in order to conserve that most recent data.

The sampling interval in the fully enabled datalogger may be modified using BioTrak II Software, the IQ Systems or manually through the Main Menu.

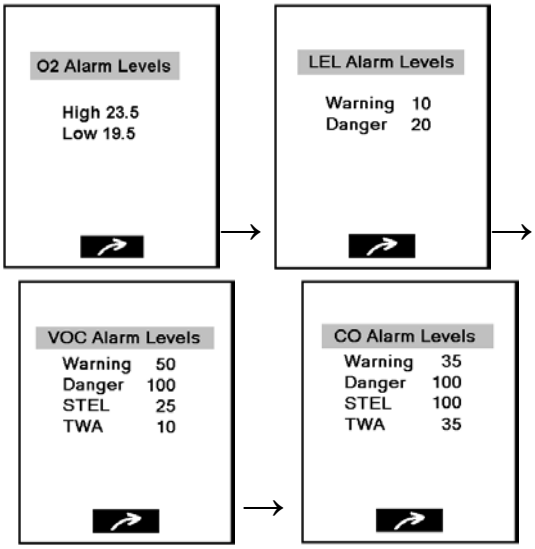
If the PHD6 is equipped with the standard black box datalogger, it will show Black Box.

In the PHD6, a one-minute sampling interval will result in the ability to store a minimum of 63 hours of readings before the oldest data is overwritten by new data.

If fewer than 5 sensors are used, the capacity will increase.

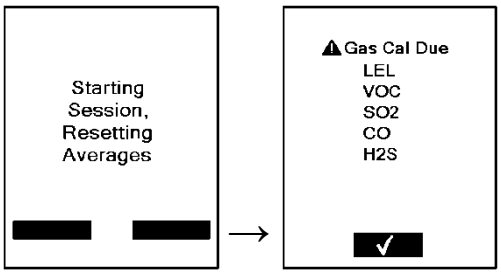
As the instrument performs a basic electronic self test, the date, time, temperature and battery type will be displayed. During the self-test, the PHD6 performs a system memory check and tests to see if a motorized pump is attached to the instrument. If a pump is detected, it will be briefly activated during the self-test. For details on start up procedures for pump-equipped PHD6 instruments see section 2.1.1 below.

The PHD6 will then display each installed sensor along with any associated alarms levels.



For more information concerning atmospheric hazard alarms, see section 2.4.

After the alarm screens, the PHD6 will show that "Starting Session, Resetting Averages" followed by the calibrations status screen. Whenever the PHD6 is turned on, it automatically starts a new operating session and resets STEL and TWA calculations. The MAX reading is also reset for the new session.



If calibration is due and the calibration due warning is enabled, the user will need to acknowledge the calibration due status by pressing the MODE button. Once the MODE button is pressed, the PHD6 will continue to the current gas readings screen and the appropriate calibration due icons will flash to remind the user that the instrument is past due for calibration. If calibration is not due, the number of days until the next calibration will be shown before the instrument proceeds to the current gas readings screen.

2.1.1 Start up with pump

PHD6 instruments that are equipped with a built-in motorized sample draw pump will have a slightly longer start up sequence. After the calibration status screens, the PHD6 will prompt you to leak test the pump.

See section 3.2 for further instructions on using the PHD6 pump.

2.1.2 Start up with PID or IR sensor

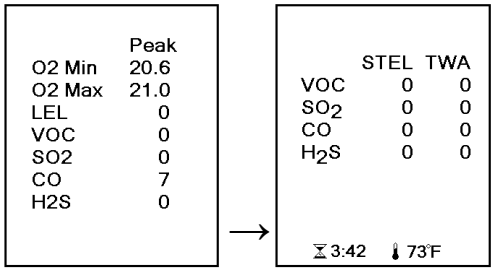
When a PID or IR sensor is installed in the PHD6, there will be a warm-up period during which the hourglass icon and either "PID" or "IR" will be shown. The VOC gas type and reading are shown in reverse text.

⚠WARNING PID and IR readings that are displayed during the sensor warm up period should not be considered accurate. The use of the PHD6 to monitor for compounds detected by the PID or IR sensor during the warm up period may lead to inaccurate and potentially dangerous readings.

2.2 Operating Logic

Once the PHD6 has completed the start up sequence, the current gas readings screen will be shown. The status bar at the bottom of the display shows time plus calibration, pump and battery status.

To turn on the backlight press the MODE button once. To view the peak readings screen, press the MODE button a second time. Press the MODE button a third time to view the Short Term Exposure Limit (STEL) and Time Weighted Averages (TWA) for the operating session.



Screens that are accessible with the MODE button (including the Peak and STEL/TWA screens) are selectable by the user. See section 5.2.6 for details.

Note: The PHD6 must be in continuous operation for at least 15 minutes before it will be able to calculate STEL or TWA values. For the first 15 minutes of any operating session, the screen will show the length of time that the instrument has been operating instead of the STEL and TWA values.

2.2.1 Status Bar

The status bar at the bottom of the current gas readings shows general information including: Battery Status

Heartbeat (instrument status)

Pump Status

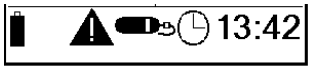
PID Hourglass (PID warmup period)

PID Lamp Status (shows "Check Sen.")

Bump Due Warning

Calibration Due Warning

Time



Battery Status Icon

The battery status icon is located at the far lower left of the screen. The battery icon gives an indication of how much power is left in the battery.

When the battery icon is empty, it is considered a low battery condition and the user should take the appropriate steps to either recharge the Li-Ion battery or replace the alkaline batteries.

For more information on the low battery alarms, see section 2.5.5.

IR Hourglass Symbol

The hourglass symbol along with IR are shown in the status bar during the IR sensor's 1-minute warm-up period. Once the warm-up period is over, the hourglass will no longer be shown.

PID Hourglass Symbol

The hourglass symbol along with PID are shown in the status bar during the PID sensor's 5-minute warm-up period. Once the warm-up period is over, the hourglass will no longer be shown.

When a PHD6 is equipped with both an IR and a PID sensor, the PID hourglass is shown since the PID sensor takes longer to warm up than the IR sensor.

Heartbeat Symbol

When the instrument is properly charged, calibrated and functioning normally, the heartbeat symbol will flash in the status bar.

Pump Status Icon

If the pump is attached and functioning, the moving fan icon will appear in the status bar.

Calibration and Bump Due Warnings

If the PHD6 is due for calibration the calibration bottle icon and triangular warning symbol will be flash in the status bar.

Time

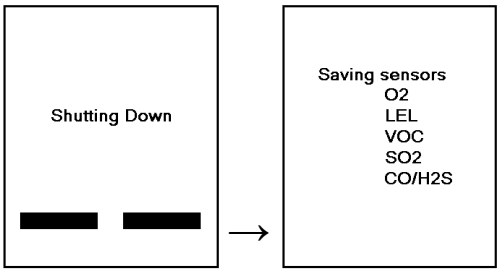
The time is shown on the current gas readings screen at the lower right.

2.2.2 Screen Flip

The screen orientation of the PHD6 may be flipped (so that it can be read looking down from above instead of up from below) by pressing the up and down arrows simultaneously at the Current Gas Readings screen.

2.3 Turning the PHD6 Off

To turn the PHD6 off, press and hold the MODE button until the display reads "Release MODE to shut down". Then release the MODE button. The display will briefly show "Shutting Down" and "Saving Sensors" before the display goes blank.



2.4 Atmospheric Hazard Alarms

The PHD6 is configured with a series of alarms that are designed to warn the user of hazardous atmospheric conditions.

⚠WARNING The PHD6 is designed to detect potentially life threatening atmospheric conditions. Any alarm condition should be taken seriously. The safest course of action is to immediately leave the affected area, and return only after further testing determines that the area is once again safe for entry.

2.4.1 O2 Alarms

The PHD6 is equipped with both high and low alarms for oxygen. Fresh air contains 20.9% oxygen.

The low oxygen alarm indicates oxygen deficiency and is normally set at 19.5% at the factory.

The high alarm indicates oxygen enrichment and is normally set at 23.5% at the factory.

2.4.2 Combustible Gas Alarms

The PHD6 is equipped with a 2-stage alarm for concentrations of combustible gas.

The default LEL warning alarm setting is 10% LEL. The default LEL danger alarm setting is 20% LEL.

The default warning alarm for NDIR-CH_4 sensors is 10% LEL or 0.5%/vol CH_4. The default danger alarm is 20% LEL or 1.0%/vol CH_4.

2.4.3 Toxic and VOC sensor alarms

The PHD6 is equipped with up to four different alarms for toxic gases and volatile organic compounds (VOCs). The combination of alarms is designed to protect the user from both chronic and acute toxic hazards.

Current alarm settings are shown during the startup sequence, and can also be accessed through the Alarms Menu.

2.4.4 Alarm Descriptions

Warning Alarms

Warning alarms indicate a hazardous atmospheric condition that has not yet risen to the level necessary to initiate the danger alarms.

Warning alarms can be temporarily silenced by pressing the MODE button.

Danger Alarms

Danger alarms indicate a significantly hazardous condition. The danger alarms cannot be silenced by the user.

STEL Alarms

STEL (Short Term Exposure Limit) alarm values represent the average concentration of instrument readings for the target gas for the most recently completed 15 minutes of operation.

TWA Alarms

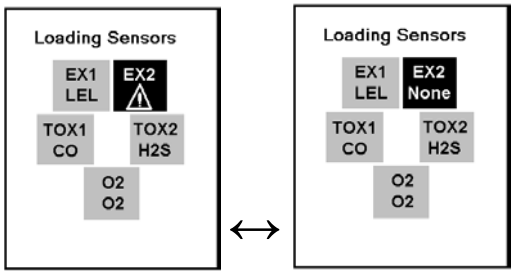
TWA (Time Weighted Average) values are calculated by taking the sum of exposure to a particular toxic gas in the current operating session in terms of parts-per-million-hours and dividing by an eight-hour period.

2.5 Other Alarms

The PHD6 will display warnings or error messages when it detects problems during operation.

2.5.1 Missing Sensor Alarms

During startup, if the PHD6 fails to detect a sensor that was present when the instrument was last turned off, it will show the sensor channel with “None” and the triangular warning symbol at the Loading Sensors screen.



Press MODE to acknowledge the missing sensor

If the PHD6 loses connection with a sensor during an operating session, it will immediately go into alarm and show an “X” in the space on the display allotted for the sensor reading. The PHD6 must be turned off to reset the missing sensor alarm.

2.5.2 Sensor Overrange alarm

The PHD6 will show a vertical double-headed arrow and go into alarm if a sensor is exposed to a concentration of gas that exceeds its established range. In the case of an LEL reading that exceeds 100% LEL, the LEL channel will be automatically disabled by the instrument and the alarm will latch (remain on) until the instrument is turned off. The PHD6 must be turned off, brought to an area that is known to be safe (containing 20.9% oxygen, 0% LEL and 0 PPM toxic gases), and then turned back on. The display will show a vertical arrow with two heads in place of the sensor reading for any channel that has gone into over range alarm.

⚠WARNING A combustible sensor overrange alarm indicates a potentially explosive atmosphere. Failure to leave the area immediately may result in serious injury or death!

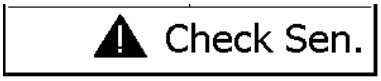
⚠WARNING In the event of an LEL overrange alarm the PHD6 must be turned off, brought to an area that is known to be safe (containing 20.9% oxygen, 0% combustible gases and 0 PPM toxic gases), and then turned on again to reset the alarm.

2.5.3 PID Lamp Out Alarm

The PID sensor in the PHD6 uses a lamp to ionize the gas sample and generate a reading.

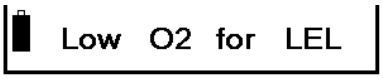
If the lamp fails to light during instrument startup, the PHD6 will attempt to start it for the duration of the warm-up cycle. If the lamp lights, the PHD6 will complete the warm-up cycle and then enter standard operating mode. If the lamp fails to light by the end of the 5-minute warm-up cycle, the instrument will display an X in the PID channel and the instrument will go into alarm. The status bar at the bottom of the screen will also show “Check Sen.” to let the user know that the PID sensor is not functioning.

The PHD6 also tests the lamp in the PID sensor at regular intervals during normal operation. If the PHD6 determines that the lamp has gone out, the X will appear on the display in the PID channel, the instrument will go into alarm and the status bar will show “Check Sen.”



2.5.4 O_2 Too Low for LEL Alarms

The LEL sensor in the PHD6 requires a certain amount of oxygen to function properly. When oxygen levels fall below 11% by volume, the PHD6 will show “X“ in place of the LEL reading and will indicate the oxygen levels are too low.



2.5.5 Low Battery Alarms

When the battery icon in the LCD appears empty, it means that a low battery condition exists. Leave the area immediately.

If the PHD6 is equipped with an alkaline battery pack, proceed to an area that is known to be safe area (containing 20.9% oxygen, 0% combustible gases and 0 PPM toxic gases) and change the batteries.

⚠WARNING The PHD6 must be located in a non-hazardous location whenever alkaline batteries are removed from the alkaline battery pack. Removal of the alkaline batteries from the battery pack in a hazardous area may impair intrinsic safety.

CAUTION Always turn the PHD6 off prior to removing the battery pack. Removal of the battery pack with the instrument turned on may cause corruption of stored data in the PHD6.

If the PHD6 is equipped with a Li-Ion battery pack, proceed to an area that is known to be safe and recharge the battery pack.

If the PHD6 continues to be used during a low battery condition, it will eventually go into a low battery alarm, and the warning alarm will sound and the screen will display the low battery warning. To silence the alarms, the user will need to acknowledge the low battery condition by pressing the MODE button before the instrument will resume monitoring. Once the MODE button is pressed, the empty battery cell and the caution icon will flash. After 5 minutes the warning will sound again. This cycle will continue until the battery reaches a “very low battery” condition, when the instrument will go into alarm for the last time, notify the user that it is shutting itself and proceed to turn itself off.

Alkaline battery replacement and Li-Ion battery charging instructions are contained in sections 6.2 and 6.3.

⚠WARNING The PHD6 must be located in a non-hazardous location during the charging cycle. Charging the PHD6 in a hazardous location may impair intrinsic safety.

2.5.6 Calibration Due Warning

If the PHD6 is due for calibration, the triangular warning symbol and span bottle icons will flash in the status bar at the bottom of the LCD once per second as a reminder.

2.5.7 Out of Temperature Range

If the operating temperature falls outside of the normal operating range of a sensor in the PHD6, the instrument will go into alarm and the thermometer icon will be shown on the display at the sensor.

2.6 PC Connection via Infrared Port

PHD6 instruments that are equipped with a fully enabled datalogger can be downloaded to a PC using BioTrak II or IQ software through the PHD6's infrared port. The IrDA port is located on the bottom of the instrument towards the back.

1. If the PHD6 is turned off, hold the MODE button down for about 5 seconds until "Communication Mode" is shown. If the PHD6 is on already, proceed to step 2.
2. Align the infrared port on the PHD6 with the PC's infrared port to complete the connection.

Note: For further instructions concerning the download procedure for the PHD6, see the BioTrak II or IQ System manual as appropriate.

2.7 PID Sensor Correction Factors

The PHD6 may be equipped with a PID (Photo Ionization Detector) sensor designed to detect Volatile Organic Compounds. The PID sensor employs an ultraviolet lamp to ionize the VOCs in the sample. The detector is then able to measure the level of the VOCs and generate a reading.

.

PID sensors are broadband in nature. This means that they are inherently non-specific. Any gas or vapor that is ionized at the UV lamp energy will give a response.

⚠WARNING It must be understood that the selection of a particular VOC or gas from the onboard PID library in the PHD6 does **not** imply that the detector will only respond to that material. It only means that the sensitivity scale (and default alarms) has been set to approximate the target material.

Regardless of the library material selected, the PID sensor always remains broadband in nature and therefore will respond to any gases/vapors in the ambient environment that are present and are ionized at the UV lamp energy. This consideration is particularly important when trace or hard to detect materials (higher correction factor (CF) are present in highly contaminated backgrounds. In this case the PID would be a poor choice for detection of the target gas/vapor.

⚠WARNING Correction factors in the PHD6 onboard PID library for various, common VOCs and gases should be considered as approximate. The PHD6 with PID has been fully tested and validated only for performance with isobutylene.

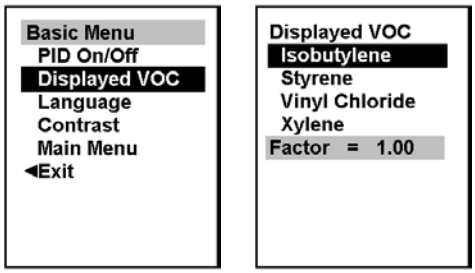
For other materials requiring verified accuracy it is necessary to calibrate the detector to the gas/vapor to be monitored directly. Further if using remote sample draw and/or physical conditions in the field that differ from ambient, to perform calibrations as close to the physical and actual setup conditions as possible.

The convention in the gas detection industry is to calibrate the PID sensor to a known concentration of isobutylene and (as required) to use response factors or to select the scale of target gas from a pre-programmed menu. Sensitivity scale is displayed on the channel with 7 character designation whether it is isobutylene or another material.

2.7.1 Displayed VOC

To change the displayed VOC, first enter the Basic Menu by holding the MODE button to turn the PHD6 off. When "Release MODE to Shut Down" is shown, continue to hold the MODE Button until the Basic Menu is shown.

At the Basic Menu press the down arrow once to select "Displayed VOC". A list of Volatile Organic Compounds will be shown. Use the navigation arrows to highlight the appropriate VOC and press MODE to select it. The new VOC will be shown when the PHD6 is restarted.



2.7.2 Specified VOC Calibration Gas

To change the calibration gas for PID sensor, follow the instruction in section 5.2.1 to reach the Main Menu. Then access the Calibration Menu followed by the Gas Values submenu. Once in the Gas Values submenu, select the VOC sensor. Then select Cal Gas Type and specify the appropriate compound and amount for calibration.

2.8 Special Instructions for NDIR sensors

Two NDIR sensors are available for the PHD6: One for the detection of carbon dioxide (CO_2), and one for the detection of methane (CH_4).

2.8.1 Special Calibration Requirement for NDIR CO_2 (Carbon Dioxide) Sensor

Unlike most sensors the Infrared CO_2 sensor requires two different gas sources to fully calibrate the instrument. The

reason for this is that it is effectively impossible to zero calibrate a CO_2 detector in ambient air because there is an unknown and varying amount of background CO_2 present in the atmosphere.

See section 4.4 for more details.

2.8.2 Special Consideration for IR CH_4 Methane sensor gas calibration

The NDIR-CH_4 sensor is designed specifically for the detection of methane. Gas calibration should always be done with methane calibration gas at the actual amount of methane shown on the cylinder. See section 4.5 for details.

2.8.3 Hydrogen Warning for IR CH_4 Methane Sensor

Unlike other types of sensors used to measure combustible gases and vapors, the IR CH_4 sensor used in the PHD6 does not respond to hydrogen.

⚠WARNING Do not use the NDIR CH_4 sensor for the detection of hydrogen. Unlike catalytic hot-bead LEL sensors, the NDIR CH_4 sensor in the PHD6 does not respond to hydrogen. Use the of the NDIR CH_4 for the detection hydrogen may lead to property damage, personal injury or death.

3. Sampling

The PHD6 may be used in either diffusion or sample-draw mode. In either mode, the gas sample must reach the sensors for the instrument to register a gas reading. The sensors are located on the front of the instrument near the bottom in a vented compartment.

⚠WARNING The sensor ports must be kept free of obstruction. Blocked sensor ports can lead to inaccurate and potentially dangerous readings.

In diffusion mode, the atmosphere being measured reaches the sensors by diffusing through vents in the instrument. Normal air movements are enough to carry the sample to the sensors. The sensors react quickly to changes in the concentrations of the gases being measured. Diffusion-style operation monitors only the atmosphere that immediately surrounds the detector.

The PHD6 can also be used to sample remote locations with either the hand-aspirated sample-draw kit, or with the motorized sample draw pump. During remote sampling, the gas sample is drawn into the sensor compartment through the probe assembly and a length of tubing.

⚠WARNING The PHD6 is delivered with a sample draw kit that contains 10 feet/3 meters of polyester urethane (fuel-resistant) tubing part number 53-001. This material is completely compatible with common combustible gases/vapors, and the toxic gases CO and H_2S. When using the PHD6 with a sample draw pump or kit to sample with any of the gas types and tubing lengths listed in the chart below, FEP-Lined Tubing (part number 53-036) should be used.

Gas Type	Tubing Length
CL_2, CLO_2	Up to 10 ft/3m Max.
HCN	Up to 100 ft/30m Max.
PID, SO_2, NO, NO_2, PH_3, NH_3	> than 10 ft/3m up to 100 ft/30m Max.

Standard polyester urethane (fuel-resistant) tubing (part number 53-001) can be used otherwise. Use of other types of tubing may cause inaccurate and potentially dangerous readings that could result in serious injury or death.

For sampling using a PID sensor please refer to the Application Note titled "Usage and Applications of PID sensors version B1" included with your PhD documentation or contact customer service at 800-711-6776 to request a copy.

⚠WARNING Do not use the NDIR CH_4 sensor for the detection of hydrogen. Unlike catalytic hot-bead LEL sensors, the NDIR CH_4 sensor in the PHD6 does not respond to hydrogen. Use of the NDIR CH_4 for the detection of hydrogen may lead to property damage, personal injury or even death.

3.1 Manual sample draw kit

The manual sample draw kit is comprised of a sample draw probe, 2 sections of tubing, a squeeze bulb and an adapter that is used to connect the sample draw accessories system to the PHD6.

Note: The maximum amount of tubing that can be used with the manual sample draw kit is 50 feet/15 meters.

3.1.1 Manual sample draw kit usage

⚠WARNING The PHD6's manual sample draw kit may not be used for the detection of chlorine (Cl_2) or chlorine dioxide (ClO_2) due to the reactive properties of these gases.

To use the manual sample draw kit:

1. Connect the short section of hose that comes off the squeeze bulb to the sample draw adapter.
2. To test the seals in the sample draw system, cover the end of the sample draw probe with a finger, and squeeze the aspirator bulb. If there are no leaks in the sample draw kit components, the bulb should stay deflated for a few seconds.
3. Secure the calibration adapter (with the sample draw assembly attached) to the PHD6 by inserting the tab and tightening the knurled screw into the brass nut at the bottom of the adapter.
4. Insert the end of the sample probe into the location to be sampled.
5. Squeeze the aspirator bulb to draw the sample from the remote location to the sensor compartment.

   To ensure accurate readings while using the manual sample draw kit, it is necessary to squeeze the bulb once for every one foot of sampling hose for the sample to first reach the sensors, and then to continue squeezing the bulb once per second for an additional 45 seconds or until readings stabilize. As an example, if 10 feet/3 meters of tubing is used, it will be necessary to draw the sample in by squeezing the bulb continuously for a minimum of 55 seconds or until readings stabilize.
6. Note the gas measurement readings.

CAUTION: Hand-aspirated remote sampling only provides continuous gas readings for the area in which the probe is located while the bulb is being continuously squeezed. Each time a reading is desired, it is necessary to squeeze the bulb a sufficient number of times to bring a fresh sample to the sensor compartment.

3.2 Motorized sample draw pump

⚠WARNING The PHD6 continuous sample draw pump (part number 54-54-102) is the only pump that can be used with the PHD6.

A motorized sample-draw pump is available for the PHD6 for situations requiring continuous "hands free" remote monitoring. The pump is powered by the PHD6 battery. When the pump is attached to the instrument, the spinning fan icon will be shown on the display in the current gas readings screen.

Note: The maximum amount of tubing that can be used with the motorized sample draw pump is 100 feet/30 meters.

To ensure accurate readings while using the continuous sample pump, it is necessary to allow the pump to draw the sample for one second for every one foot of sampling hose plus an additional 45 seconds or until readings stabilize. For example, with 10 ft/3m of tubing, it will be necessary to allow a minimum of 55 seconds for the sample to be drawn into the sensor chamber and for the readings to stabilize.

PHD6 instruments are designed to automatically recognize the pump whenever it is attached to the instrument. If the pump is attached when the PHD6 is turned off, the instrument will automatically initiate the pump start up sequence when the instrument is turned on. If the pump is attached while the instrument is running, the PHD6 will automatically initiate the pump test sequence before returning to the current gas readings screen.

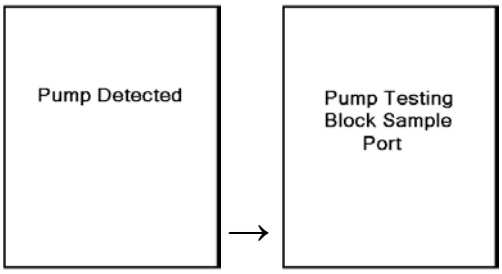
⚠WARNING Do not use the PHD6 pump for prolonged periods in an atmosphere containing a concentration of solvent or fuel that may be greater than 50% LEL.

3.2.1 Starting the motorized sample pump

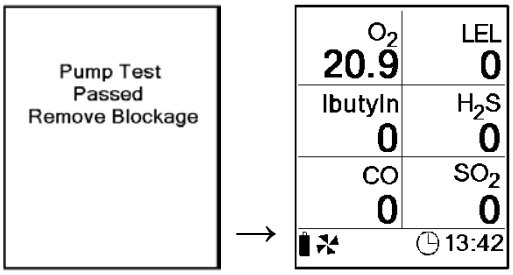
First attach the probe and tubing to the pump, then secure the pump (with the sample draw assembly attached) to the PHD6 by hooking the tabs on the pump into the corresponding slots on the back of the PHD6. Once the pump is in position over the sensors, tighten the knurled screw on the adapter into receptor at the center of the sensor cover.

Note: The sample probe assembly must be attached to the pump when the pump is attached to the instrument.

Once the pump is recognized, the pump test sequence will be initiated automatically. The instrument will instruct you to block the sample inlet.



Block the sampling inlet by placing a finger over the end of the sample probe assembly. Once the blockage is detected, the PHD6 will indicate that the test has been passed and instruct you to remove the blockage. Once the blockage is removed, it will proceed to the current gas readings screen and the pump icon will be shown in the status bar.

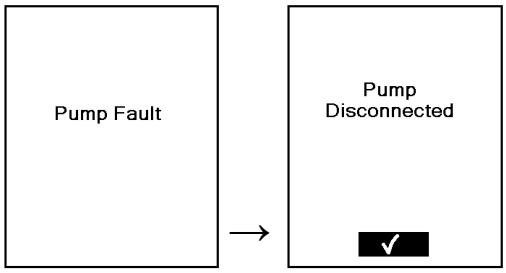


If the instrument is unable to detect the vacuum resulting from the pump blockage within 30 seconds, the test will fail, the instrument will go into alarm and you will be directed to remove the pump.

Remove the pump and press the MODE button to resume diffusion operation.

3.2.2 Turning off the pump

To turn off the pump, simply remove the pump from the bottom of the instrument. The screen will show “Pump Fault” followed by “Pump Disconnected”. Press MODE to continue without the pump.

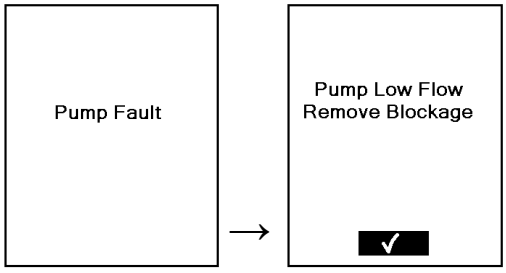


3.2.3 Pump low flow alarm

The PHD6 Pump contains a pressure sensor that continuously monitors for restrictions in airflow caused by water or other fluids being drawn into the unit and immediately acts to turn the pump off in order to protect the sensors, pump, and other PHD6 components from damage.

CAUTION: Never perform remote sampling with the PHD6 without the sample probe assembly. The sample probe handle contains replaceable filters designed to block moisture and remove particulate contaminants. If the pump is operated without the probe assembly in place, contaminants may cause damage to the pump, sensors and internal components of the PHD6

When the pump is active and functioning properly, the moving pump icon is shown on the lower status bar on the display. Low flow or other pump fault conditions activate audible and visible alarms and cause the display of the appropriate explanatory message.



Press MODE once the blockage has been cleared to restart the pump.

The pressure sensor in the sample draw pump is designed to detect pressure changes while the sample-draw probe is being held in a vertical position. If the probe is held horizontally or at a low angle while inserted into a fluid, a pressure drop sufficient to cause the pump to shut down may not be generated, and water could be drawn into the pump assembly causing damage to the pump, sensors and internal components of the PHD6.

CAUTION: Insertion of the sample draw tube into a fluid horizontally or at a low angle may lead to water ingress and may cause damage to the sensors and internal components of the PHD6.

If the PHD6 determines that a significant increase in pressure has occurred, it will go into alarm and notify the user that there is a blockage of the pump. The display will alternate between the following two screens.

Remove the blockage and press the MODE button to acknowledge the alarm and resume sampling.

3.3 Sample draw probe

The PHD6’s sample draw probe is the standard probe assembly from Honeywell. The sample probe handle contains moisture barrier and particulate filters designed to remove contaminants that might otherwise harm the instrument.

Particulate contaminants are removed by means of a cellulose filter. The hydrophobic filter includes a Teflon™ barrier which blocks the flow of moisture as well as any remaining particulate contaminants.

Sample probe filters should be replaced whenever visibly discolored due to contamination.

See section 6.5 for a probe diagram and a list of available sample probe filter replacement kits.

4. Calibration

The accuracy of the PHD6 should be verified on a regular basis. Verification can be as simple as performing a bump test, which is described below in section 4.1. If the instrument fails the fresh air test, then it must be fresh air calibrated before use. If the instrument fails the bump test with calibration gas, it must be successfully span calibrated before use.

Note: The NDIR-CO_2 sensor used in the PHD6 cannot be zero calibrated in fresh air. For specific instructions on calibrating the CO_2 sensor, proceed to section 4.4.

Note: The NDIR-CH_4 sensor used in the PHD6 must be calibrated with methane calibration scale to the actual amount of methane in the cylinder in terms of percent volume methane. See section 4.5 for details.

*** ⚠WARNING The Canadian Standards Association (CSA) requires combustible gas sensors to be bump tested prior to each day’s use with calibration gas containing between 25% and 50% LEL. The functional (bump) test procedure is covered in section 4.1.**

**** ⚠WARNING The Canadian Standards Association (CSA) requires combustible gas sensors to undergo calibration when the displayed value during a bump test fails to fall between 100% and 120% of the expected value for the gas.**

For Honeywells’ official recommendations concerning calibration frequency, see Appendix B.

4.1 Functional (Bump) testing

The accuracy of the PHD6 may be verified at any time by a simple functional (bump) test.

To perform a functional (bump) test, do the following:

1. Turn the PHD6 on and wait at least three minutes to allow the readings to fully stabilize. If an IR or PID sensor is in use, wait until the stabilization period ends before proceeding. If any of the sensors have just been replaced, the new sensor(s) must be allowed to stabilize prior to use. See section 6.4 for further details on sensor stabilization requirements.
2. Make sure the instrument is located in fresh air.



Figure 4.1 Bump Test / Gas calibration set up

3. Verify that the current gas readings match the concentrations present in fresh air. The oxygen (O_2) sensor should read 20.9%/vol. (+/-0.2%/vol.). The readings for the LEL sensor should be 0% LEL. The PID, NDIR-CH_4 and toxic sensors should read 0 parts-per-million (PPM) in fresh air. For the NDIR-CO_2 sensor, a carbon dioxide level between 0.03% and 0.10% is considered normal in fresh air. If the readings deviate from the expected levels in a fresh air environment, proceed to section 4.2 and perform the fresh air calibration adjustment then proceed to step 4.
4. Attach the calibration adapter and connect the calibration cylinder to the PHD6 as shown in figure 4.1. Flow gas to the sensors.
5. Wait for the readings to stabilize. (Forty-five seconds to one minute is usually sufficient.)
6. Note the readings. Toxic, VOC and combustible gas sensor readings are considered accurate in a bump test if they are between 90%* and 120% of the expected reading as given on the calibration cylinder. If the readings are considered accurate, then the instrument may be used without further adjustment. If the readings do not fall within 90%* and 120% of the expected reading as given on the calibration cylinder, then readings are considered inaccurate. If readings are considered inaccurate, proceed to section 4.3 and perform the gas calibration.

***Note: The Canadian Standards Association (CSA) requires combustible gas sensors to undergo calibration when the displayed value during a bump test fails to fall between 100% and 120% of the expected value for the gas.**

Honeywell multi-calibration gas mixtures contain approximately 18% oxygen. During the bump test the oxygen sensor should read within +/-0.5% of the level given on the calibration cylinder.

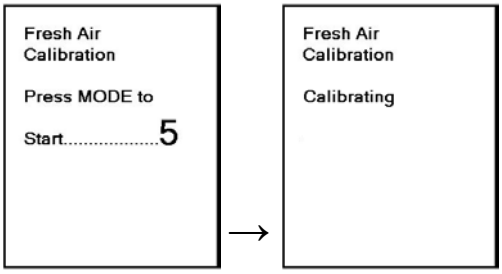
4.2 Fresh Air/Zero Calibration

Note: The NDIR-CO_2 sensor in the PHD6 may not be zero calibrated in fresh air. See section 4.4 for further instructions.

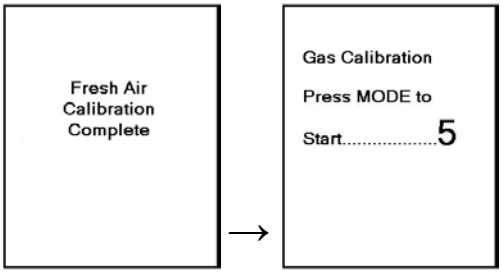
⚠WARNING Fresh air/zero calibrations may only be performed in an atmosphere that is known to contain 20.9% oxygen, 0.0% LEL and 0 PPM toxic gas.

To initiate the fresh air/zero calibration:

1. Press the MODE button three times within two seconds to begin the fresh air/zero calibration sequence. The PHD6 will briefly display AUTO CAL and then begin a 5-second countdown.
2. Press the MODE button before the end of the 5-second countdown to begin the fresh air/zero calibration. The fresh air/zero calibration is initiated when the PHD6 shows “Calibrating” on the screen.



3. The PHD6 will indicate when the fresh air/zero calibration is complete. It will then proceed to a second 5-second countdown for the gas calibration. If gas calibration is not required, allow the countdown to reach 0 without pressing the MODE button.



For instructions on the Gas Calibration, proceed to section 4.3.

4.2.1 Fresh air calibration failure

In the event of a fresh air calibration failure, the alarms will be activated and the instrument will display the following screen. Note that the sensor(s) that fail the zero calibration are shown (in this case, CO)

After 3 seconds, the PHD6 will return to the current gas readings screen and the visual and audible alarms will cease.

When calibration is due, the triangular warning symbol along with the span bottle icon the PHD6’s status bar will show

If a successful fresh air calibration is not performed prior to instrument shut down, the PHD6 will note that Fresh Air Calibration is due during instrument start up.

Possible causes and solutions

1. The atmosphere in which the instrument is located is contaminated (or was contaminated at the time the instrument was last fresh air calibrated.
2. A new sensor has just been installed.
3. Instrument has been dropped or banged since last turned on.
4. There has been a significant change in temperature since the instrument was last used.

Recommended action:

Take the instrument to fresh air and allow readings to stabilize. Perform the fresh air/zero adjustment again. If the manual fresh air/zero procedure fails to correct the problem, perform the manual fresh air / zero calibration procedure as described in section 4.2.2 below.

4.2.2 Forced fresh air calibration

The PHD6 includes safeguards to prevent fresh air calibration in contaminated environments. If the standard

fresh air calibration fails a second time, the instrument may be "forced" to accept the fresh air calibration by performing the manual fresh air calibration.

⚠WARNING Fresh air calibrations may only be performed in an atmosphere that is known to contain 20.9% oxygen, 0.0% LEL and 0 PPM toxic gas. Performing a fresh air calibration in a contaminated atmosphere may lead to inaccurate and potentially dangerous readings.

1. Initiate the standard fresh air / zero calibration sequence by pressing the MODE button three times in rapid succession. The 5-second countdown will begin.
2. Press and hold the down arrow key and then press the MODE button before the end of the 5-second countdown. Continue to hold the down arrow.
3. The fresh air/zero calibration is complete when the instrument begins another 5-second countdown for the gas calibration. If gas calibration is not required, allow the countdown to reach 0 without pressing the MODE button.

If the PHD6 still fails to calibrate after this procedure is attempted, contact Honeywell.

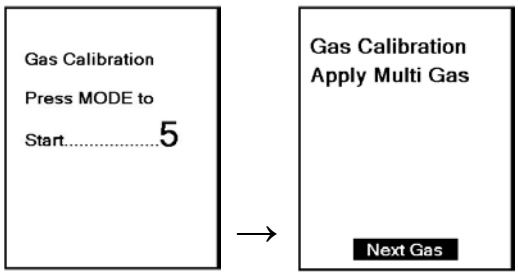
4.2.3 Fresh air calibration in a contaminated atmosphere

To fresh air calibrate the PHD6 in a contaminated atmosphere, connect a cylinder of "zero air" containing 20.9% oxygen and no contaminants to the PHD6 and flow gas to the instrument. Then perform the fresh air calibration. See figure 4.1 above for setup.

4.3 Gas Calibration

Once the fresh air / zero calibration has been successfully completed, the PHD6 will automatically proceed to the automatic gas calibration countdown screen.

Press the MODE button before the countdown is complete to initiate the gas calibration. The screen will immediately show "APPLY GAS" and then list the sensors for calibration and the expected levels of calibration gas.



Note: Honeywell recommends the use of multi-component calibration gas for calibrating the PHD6.

Apply calibration gas. The readout will change to a numerical display almost immediately and show the current readings along with the expected calibration gas value.

If multiple cylinders are required to complete the calibration, the PHD6 will prompt the user to apply the next cylinder as needed.

As sensors are calibrated, the PHD6 will briefly show the reserve values for each sensor. The reserve values give an indication of the remaining sensitivity of the sensors. When the reserve value for a specific sensor reaches 0%, it is time to replace the sensor.

The oxygen sensor is tested for response to diminished oxygen levels during gas calibration. Honeywell multi-gas calibration cylinders contain approximately 18.0% oxygen. In order to pass the gas calibration, the PHD6 must register an oxygen reading below 19.5% during gas calibration. If the detector fails to register the reduced oxygen levels during the gas calibration, it will show "Check O2 Sensor Response". Press MODE to acknowledge.

See section 4.3.2 below if the oxygen sensor does not detect the drop in oxygen level and fails the gas calibration.

Note: Disconnect the calibration assembly as soon as the calibration is complete.

4.3.1 Gas calibration failure: All sensors except oxygen

When there is a gas calibration failure, the display will show CAL Error and display the sensor whose calibration has failed.

If the instrument fails to recognize the correct type or concentration of calibration gas, it will show "no GAS".

When gas calibration is due, the PHD6's display will show the warning symbol while intermittently displaying the calibration bottle in the gas readings screen.

The PHD6 will also display a "Needs Cal" message for any sensors that are currently due for calibration during instrument start-up.

Possible causes of gas calibration failure and remedies:

1. Empty calibration gas cylinder. Verify that there is calibration gas in the cylinder.
2. Expired calibration gas cylinder. Verify that the expiration date on the cylinder has not passed.
3. Calibration gas setting does not correspond to calibration gas concentration. If the values on the calibration cylinder differ from the calibration gas settings in the PHD6, the PHD6's calibration gas settings must be changed to match the new values. Changing the calibration gas settings can be done manually through the MODE button or through BioTrak II using an IrDA link to the instrument.
4. LEL only: Type of calibration gas (standard) has changed significantly. LEL calibration gas may be based on several different response standards. Methane, propane and pentane are the most common. If using a new cylinder of calibration gas, make sure that the type and amount of combustible gas is identical to that of the previous bottle. Honeywell offers calibration gases in Methane, Propane Equivalent and Pentane Equivalent.
5. Dead sensor. Replace sensor.
6. Instrument problem. Return the instrument to Honeywell. Call the phone number on the front of this manual.

4.3.2 Gas calibration failure: Oxygen sensors

Honeywell multi calibration gas cylinders contains approximately 18.0% oxygen. The reduced oxygen level in the calibration gas cylinder allows the oxygen sensor's response to be tested in the same manner as the toxic and LEL sensors.

If the O2 sensor fails to register a reading below 19.5% during the gas calibration, the display will show "Check O2 Sensor Response". Press MODE to continue.

If the oxygen sensor fails to register the drop in oxygen during the gas calibration while being challenged with calibration gas containing less than 19.0% oxygen, it should be considered out of tolerance and retired from service immediately.

See section 5.2.4 under Gas Values for more information on the O2 sensor check.

⚠WARNING A sensor that cannot be calibrated or is found to be out of tolerance should be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.

Possible causes and remedies for oxygen sensor failure:

1. Calibration gas cylinder does not contain a reduced level of oxygen. Verify that the cylinder contains less than 19.0% oxygen.

   To challenge the oxygen sensor without calibration gas, hold your breath for about 10 seconds and then **slowly** exhale directly onto the face of the sensor (in the same way you would attempt to fog up a piece of glass). If the descending oxygen alarm is set to 19.5%, the instrument should go into alarm after a few seconds. If the oxygen sensor fails to go into alarm during the exhalation test, the oxygen sensor must be replaced.
2. Oxygen sensor has just been replaced and has not had time to stabilize.
3. Oxygen sensor failure.

4.4 Special Calibration Instruction for NDIR CO_2 sensor

The Infrared CO_2 sensor requires two different gas sources for full calibration. The reason for this is that it is effectively impossible to zero calibrate a CO_2 sensor in ambient air because there is an unknown and varying amount of background CO_2 present in the atmosphere.

4.4.1 CO_2 Sensor True Zero

To determine if the CO_2 sensor requires zero calibration, connect the PHD6 to a cylinder of calibration gas that contains 0.00% CO_2 while the instrument is in normal operation.

If the reading shows 0.00% CO_2, then the CO_2 sensor does not require zero calibration. Disconnect the cylinder from the PHD6.

If the reading shows anything other than 0.00% CO_2, leave the calibration gas on and press the MODE button three times within two seconds to initiate the zero calibration sequence. Press MODE again when prompted to begin the zero calibration. Instruments equipped with a CO_2 sensor will automatically show the message "Press MODE if applying Zero Air" with another 5-second countdown. Press MODE again to begin the true zero calibration and follow the instructions given on the screen. Once the zero calibration is complete, remove the zero air cylinder from the instrument and proceed to the gas calibration (if necessary).

The gas calibration of the CO_2 sensor is performed during the standard gas calibration that is described above in section 4.3. The PHD6 will automatically prompt the user to apply the CO_2 calibration gas during the standard gas calibration sequence.

4.5 Special Calibration Instructions for NDIR-CH_4 Sensor

In many ways, the NDIR-CH_4 sensor used in the PHD6 is similar to a hot bead LEL sensor. For the purpose of calibration, they are very different. While LEL sensors can be calibrated with a number of other gases when properly configured, The NDIR-CH_4 sensor must be calibrated with methane to the exact amount shown on the calibration gas cylinder. (This is different from LEL sensors, where methane may be used for calibration, but is often done at a scale that makes the readings mimic those given by a specific amount of propane or pentane).

⚠WARNING The NDIR CH_4 sensor in the PHD6 must be calibrated using methane (CH_4) calibration gas at the actual amount shown on the cylinder. The default calibration gas value for the NDIR-CH_4 sensor is 50% LEL. The appropriate calibration gas level for the 50% LEL default calibration gas setting is 2.50%/vol. CH_4. Use of inappropriate calibration gas may lead to inaccurate and potentially dangerous readings.

5. Menu Options

The PHD6 operating firmware includes two menu options: the Basic Menu and the Main Menu.

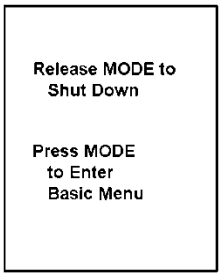
5.1 Basic Menu

The Basic Menu is a shortened version of the Main Menu that offers immediate access to a few key functions including:

- PID On/Off (enable or disable the PID sensor)
- Displayed VOC (select the target compound for the VOC sensor)
- Contrast (display's light vs. dark setting)
- Main Menu access

5.1.1 Entering the Basic Menu

To access the Basic Menu, with the PHD6 on and the current gas readings screen shown, hold the MODE button down until the PHD6 beeps four times and the "Release MODE to Shut Down" is shown. Then continue to hold the MODE Button until the Basic Menu is shown.





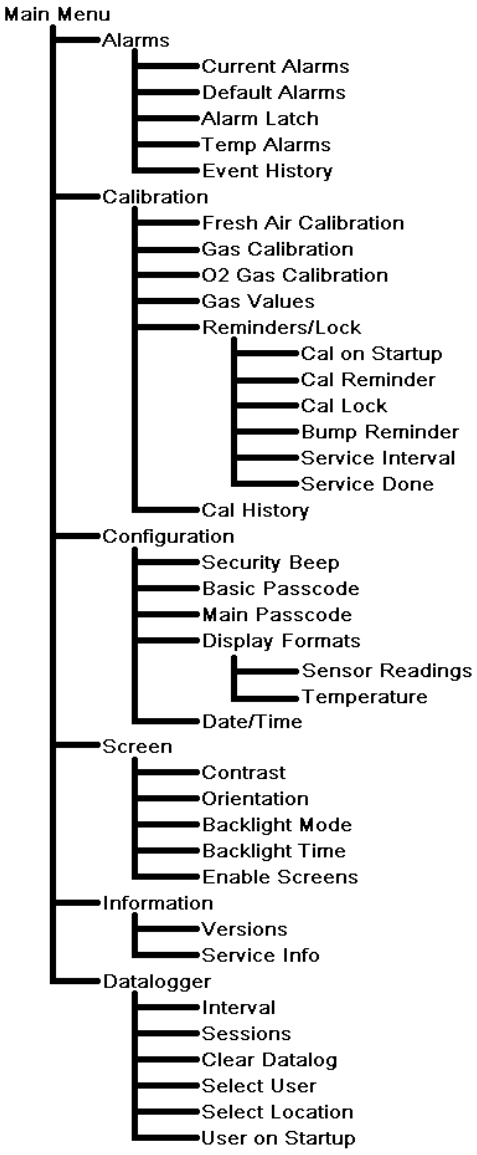
To navigate through the menu options, use the up and down navigation arrows to highlight the desired submenu and press MODE to enter the submenu.

5.2 Main Menu

The PHD6 is fully configurable through the Main Menu. The Main Menu contains 6 sub menus that lead to controls for the individual instrument functions.

To navigate through the menu options, use the up and down navigation arrows to highlight the desired submenu and press MODE to enter the submenu.

To navigate through the menu options, use the up and down navigation arrows to highlight the desired submenu and press MODE to enter the submenu.



Main Menu Options Diagram

5.2.1 Entering the Main Menu

There are two paths into the main menu.

If the instrument is **on**, press and hold the MODE button down for three seconds until "Shutting Down" is shown, then release the MODE button. The next screen will show "shutting down…" along with two black blocks at the bottom of the screen. Press and hold the two arrow keys while the two blocks are shown to enter the main menu.

If the instrument is **off**, press the MODE button to start the instrument. When "Starting Session, Resetting Averages" is shown along with two black blocks, press and hold the two arrow keys while the two blocks are shown to enter the main menu.

The Main Menu is the access point to 6 submenus that control virtually every aspect of the PHD6's functionality.

NOTE: Changes made in the Main Menu can have a direct affect on the PHD6's functionality and should only be made by those who are trained in proper gas detection and monitoring techniques.

5.2.2 Using the submenus.

In the Main Menu and the sub-menus, use the up and down arrows to navigate between the options and press MODE to enter. Three buttons will appear on the display to show the

functions of the MODE button and the two navigation keys on any screen that allows instrument setup changes.

5.2.3 Alarms Menu

The Alarms Menu contains the following 6 submenus (options in parenthesis). Description follows (as needed).

- **Current Alarms** (select any sensor to view current sensor alarm settings, then select any current sensor alarm to make changes)
- **Default Alarms** (scroll to view default sensor alarms for each recognized sensor plus option to Set Default Alarms for all sensors
- **Alarm Latch** (set on or off)

  The PHD6's alarms are self-resetting unless the alarm latch is enabled. With the PHD6's alarm latch enabled, the audible and visible alarms will continue to sound after the atmospheric hazard has cleared. Press the MODE button to reset the alarms. If the alarm latch is disabled and the alarm condition is no longer present, the instrument will automatically return to normal operation, and the visible and audible alarms cease without further input from the user.

- **Temp Alarms** (enable or disable high and low temperature alarms)

  If the operating temperature falls outside of the operating range of the PHD6, the instrument will go into alarm and the thermometer icon will be shown on the display.

- **Event History** (use up and down arrows to scroll through saved alarm events – includes time, duration and peak and average sensor readings during the event)

- **Vibrator** (if equipped) (enable or disable the vibrating alarm)

5.2.4 Calibration Menu

- **Fresh Air Cal** (initiates Fresh Air Calibration sequence)

⚠WARNING Fresh air/zero calibrations may only be performed in an atmosphere that is known to contain 20.9% oxygen, 0.0% LEL and 0 PPM toxic gas.

- **Gas Calibration** (initiates Gas Calibration sequence (calibration gas required)
- **O_2 Gas Cal** (initiates true O_2 Zero Calibration sequence)

  Note that this procedure requires a cylinder of calibration gas that contains 0.0% oxygen.
- **Gas Values** (select any sensor to view or change current calibration gas values).

  Note: The selection of the calibration gas for the PID sensor is NOT linked to the displayed substance. A ratio is used to calculate readings for various VOCs against the calibration standard. See section 2.7 for more details on the PID gas values.

  Note: In the case of the oxygen sensor, the O_2 gas setting can be used to enable or disable the oxygen sensor check that takes place during gas calibration with multi calibration gas. To disable the oxygen sensor check, select "No".

⚠WARNING Disabling the oxygen sensor check may result in the failure to recognize an oxygen-deficient atmosphere.

Always use a multi cal gas cylinder containing 18% oxygen to calibrate the PHD6.

- **Reminders/Lock** (access to submenus below)

  Cal on Startup (enable or disable)

  When enabled, calibration is automatically initiated whenever the instrument is turned on. The calibration can be bypassed (unless Cal Due Lock is enabled) by letting the clock run out and proceeding to the current gas readings screen. Cal on Startup is usually disabled on new instruments and must be enabled by the user.

  Cal Reminder: (adjust between every day and every 180 days). The default setting for standard instruments leaving the factory is 30 days.

  To disable the cal reminder, set the value to 0.

  Cal Lock: (enable or disable)

  Enable to require calibration when the Cal Reminder is on. PHD6 automatically shuts down if Cal Lock is enabled, and calibration is due but not performed. Cal Lock is usually disabled on new instruments and must be enabled by the user.

  Bump Reminder: (enable, disable and adjust between every day and every 30 days)

  Used exclusively with the IQ6 Dock. Reminds the user to process the instrument in the dock. To disable set the value to 0. The Bump Reminder is usually disabled on new instruments and must be enabled by the user.

  Service Interval (enable, disable and adjust between every day and every 730 days (2 years)

  The service interval is a reminder that tells the user when the instrument is due for service. The Service Interval is usually disabled on new instruments and must be enabled by the user.

  Service Done (reset service date)

  Used to reset the service interval following instrument service.
- **Cal History** (scroll through recent calibrations, includes span reserve listing – which allows for predictive maintenance)

5.2.5 Configuration Menu

- **Security Beep** (enable or disable)

  Once enabled the PHD6 will emit a short audible beep and give a short flash on the LEDs at a user-defined interval to notify the user that the instrument is powered up and running. The Security Beep is usually disabled on new instruments and must be enabled by the owner.
- **Basic Passcode** (enable, disable and change passcode)

  Enable to require the entry of a passcode to access the Basic Menu. The Basic Passcode is usually disabled on new instruments and must be enabled by the owner. To permit access to the Basic Menu, and restrict it from the Main Menu, the Basic Passcode must differ from the Main Passcode.
- **Main Passcode** (enable, disable and change passcode)

  Enable to require the entry of a passcode to enter the Main Menu. The Main Passcode is usually disabled on new instruments and must be enabled by the owner. The Main Passcode can be used to enter both the Main Menu and the Basic Menu.
- **Display Formats** (contains submenus for sensor readings, sensor clamping and temperature)
  - **Sensor readings** (for toxic gases select PPM (XX) or tenths-of-a-PPM (X.X) for sensors with this capability (such as H_2S). For NDIR-CH_4 choose between LEL and CH_4 (the CH_4 reading will display in

    %/Vol.) Sensors that cannot be adjusted will show "Fixed".
  - **Temperature** (select display in Celsius or Fahrenheit) Most PHDs leave the factory configured to read temperature in Fahrenheit unless the customer requests otherwise.
- **Language** (select English, French or Spanish). Most PHDs leave the factory configured in English unless the customer requests otherwise.
- **Date/Time** (set time and date)

5.2.6 Screen Menu

- **Contrast** (screen contrast setting)
- **Orientation** (shifts display to be viewable from top or bottom of the instrument)

- **Backlight Mode** (select continuous, Timed Off or Time Auto)

  Select **Continuous** to have the backlight on at all times,

  Select **Timed Off** to require a MODE press or an alarm condition to activate the backlight. The default setting for most new PHD6 instruments when leaving the factory is to turn the backlight off after 20 seconds.

  Select **Time Auto** to enable the automatic backlight for low light conditions.
- **Backlight Time** (set the time before the backlight turns off in Time Off Mode)
- **Enable Screens** (select the screens that are accessible by sequentially pressing the MODE button including: Peak, Average, STEL and TWA screens.

5.2.7 Information Menu

- **Versions** (view instrument serial number, software version, and time and date of instrument manufacture)
- **Service Info** (view Honeywells' phone contact numbers).

5.2.8 Datalogger Menu

- **Interval** (set datalogger interval between 1 second and 1 hour) (menu option only not available in Black Box Datalogger versions)

  The datalogger samples continuously, so the data stream must be broken into intervals to be recorded. The datalogging interval defines the frequency of the breaks in the data stream. The interval may be set anywhere between one second and one hour by using the navigation arrows as detailed below. The default datalogging interval is 1 minute. At a one-minute interval, the PHD6 will log a minimum of 63 hours of data before the oldest data is overwritten by newer data.
- **Sessions** (view datalogger session data including date, time, interval, temperature and sensor minimum and maximum readings)
- **Clear Datalog** (clears all information from the datalogger)
- **Select User** (User name will be saved in the session data)

  Users' names must be entered in BioTrak II to appear in the user list.
- **Select Location** (Location name will be saved in the session data)

  Location names must be entered in BioTrak II to appear in the location list.
- **User on Startup** (enable or disable a prompt to select user and location at startup)

  User and location names must be entered into the instrument via BioTrak II before this option can be enabled.

6. Maintenance

⚠WARNING To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing any parts in the PHD6.

6.1 Batteries

The PHD6 is powered by interchangeable alkaline and Li-Ion rechargeable battery packs.

To remove the battery pack first loosen the top center screw on the back of the instrument, then gently pull the top of the battery away from the instrument. The battery is hinged from below. Remove the battery once the top clears the upper housing by pulling up and away.

CAUTION Always turn the PHD6 off prior to removing the battery pack. Removal of the battery pack with the instrument turned on may cause corruption of stored data in the PHD6.

Note: Center screw on ATEX / European version may be slightly different.

6.2 Replacing alkaline batteries

The alkaline battery pack contains three AA alkaline batteries.

⚠WARNING The PHD6 must be located in a non-hazardous location whenever alkaline batteries are removed from the alkaline battery pack. Removal of the alkaline batteries from the battery pack in a hazardous area may impair intrinsic safety.

⚠WARNING Use only Duracell MN1500 or Ultra MX1500, Eveready Energizer E91-LR6, Eveready EN91 batteries. Substitution of batteries may impair intrinsic safety.

To replace the alkaline batteries:

1. Remove the battery pack from the PHD6 as discussed in above in section 6.1.
2. Loosen the two screws at the top of the battery pack by turning each ¼ turn counterclockwise.
3. Remove the three alkaline batteries and replace them. Be sure to align the positive and negative ends in accordance with the diagram under each battery.
4. Reinstall the back cover plate that was removed in step 2.
5. Return the battery pack to the PHD6 and re-tighten the top center screw. The PHD6 will automatically turn itself on once the battery pack is reinstalled.

6.3 Maintaining Li-Ion battery packs

The PHD6 may be equipped with a rechargeable Li-Ion (Lithium Ion) battery pack.

6.3.1 Storage guidelines for the Li-Ion battery

Never store Li-Ion -version PHD6 instruments at temperatures above 30 degrees Celsius (86 degrees Fahrenheit). Li-Ion batteries may suffer deterioration resulting in damage to the internal components when stored at high temperatures. The battery may be irretrievably damaged resulting in reduced battery capacity and voltage.

Honeywell recommends leaving PHD6 instruments with Li-Ion rechargeable batteries on the charger when not in use.

6.3.2 Charging guidelines for Li-Ion battery

The Li-Ion battery in the PHD6 should never be charged at temperatures lower than 5 degrees Celsius (40 degrees Fahrenheit) or higher than 30 degrees Celsius (86 degrees Fahrenheit. Charging at temperature extremes can permanently damage the PHD6 Li-Ion battery.

⚠WARNING The PHD6 must be located in a non-hazardous location during the charging cycle. Charging the PHD6 in a hazardous location may impair intrinsic safety.

6.3.3 Charging procedure for Li-Ion battery

⚠WARNING Do not charge the PHD6 with any charger other than the appropriate PHD6 charger manufactured by Honeywell. Standard versions of the PHD6 must be charged with the UL/CSA-approved charger, which is part number 54-54-001. European versions of the PHD6 must be charged with the ATEX-approved PHD6 charger.

1. Verify that the instrument is turned off. (If it is not, press the MODE button for three seconds until the message "Release Button" appears.)
2. Plug the power supply in. The red LED is labeled “Power” and will be lit whenever the charger is plugged into a power source.
3. Insert the PHD6 into the charging cradle bottom side down with the display facing forward. The green LED on the charger is labeled “Charge” and will blink while the battery is charging.
4. When the battery is fully charged, the green “Charge” LED will be lit and not blinking.

See section 5.3.4 for battery troubleshooting guidelines.

6.3.4 Charging with the pump attached

The PHD6 with pump attached may be charged according to the instruction given in section 6.3.3 above.

6.3.5 Battery troubleshooting

If the green “Charge” LED on the charger fails to light when the PHD6 with Li-Ion battery pack is placed in the charger, remove the instrument from the charger and press the MODE button to attempt to start the instrument.

If the battery has been inserted into the charger without the instrument, return it to the instrument prior to attempting the restart.

1. If the PHD6 starts and the battery icon if full, then the battery is fully charged and may be used as is. In this case, the charger has recognized that the battery is charged and will not charge it any further.
2. If the PHD6 fails to turn on, then the battery may be severely discharged and should be returned to the charger. The charger will then begin a very slow recharge in order to protect the battery. The green “Charge” LED may not be lit during the first four hours of the slow recharge. If the “Charge” LED has still not been lit after four hours, the battery pack or charger is probably damaged.
3. If the PHD6 starts and any battery level other than full is indicated, then either the battery is damaged or the charger is damaged. Call Honeywell for further instructions.

6.4 Sensors

6.4.1 Sensor replacement

The sensors in the PHD6 are located in a vented compartment at the bottom of the instrument.

To install a sensor:

1. Turn the PHD6 off.
2. Remove the battery pack as described in section 6.1. This will automatically disconnect power from the instrument.
3. Remove the four screws that are located below the battery pack insertion from the back face of the PHD6.
4. Turn the instrument over to reveal the front face and gently remove the sensor cover.
5. Remove the sensor that is to be replaced.
6. Insert the new sensor into the appropriate location on the sensor board.
7. Reinstall the sensor cover by aligning it properly over the sensors and securing it with the four screws that were removed in step 3.
8. Reattach the battery pack and re-tighten the top center screw.
9. New sensors must be allowed to stabilize prior to use according to the following schedule. The detector must be powered off and a functional battery pack must be installed for the sensor to stabilize.

Sensor	Stabilization Period
Oxygen (O_2)	1 hour
LEL	none
PID	5 minutes
NDIR-CH_4 or NDIR-CO_2	1 minute
All Toxic Sensors except NO	15 minutes
NO (nitric oxide)	24 hours

Note: Steps 9 and 10 assume that the sensor stabilization period has passed.

10. Perform the Fresh Air/Zero calibration and the Gas calibration as discussed in sections 4.2 and 4.3.

6.4.2 Care and maintenance of PID sensors

The two critical components of a PID sensor are the electrode stack and the lamp. The electrode stack can be replaced in the field. The lamp can be cleaned or replaced in the field. The frequency of maintenance to both items will vary with the type of usage and the nature of the contaminants to which the sensor is exposed.

As a general rule, baseline shifts tend to be caused by the electrode stack and losses of sensitivity tend to be caused by the lamp.

6.4.2.1 Troubleshooting the PID

When to replace the electrode stack:

1. Baseline reading climbs following fresh air zeroing of the sensor.
2. PID sensor becomes sensitive to humidity.
3. Baseline becomes generally unstable.
4. Baseline shifts when the instrument is in motion.

When to clean the PID lamp

Loss of sensitivity in the sensors as shown during bump-testing (reading will be low).

When to replace the PID lamp

If the cleaning of the lamp fails to correct a loss of sensitivity, the lamp should be replaced.

6.4.2.2 Cleaning and replacing PID components

To remove the lamp and stack

1. Wash your hands thoroughly.
2. On a clean surface, remove the PID sensor from the PHD6 as described above (section 6.4.1 steps 1-5).
3. Place one finger on top of the sensor and insert the stack removal tool into the two slots at the top side of the sensor body. Squeeze gently until the spring releases and the stack can be removed from the top of the sensor. The lamp is spring-loaded against the stack, so keeping a finger on top of the stack prevents their ejection from the sensor body.
4. Gently remove the stack and pull the lamp and spring out of the sensor body. Do not touch the top of the lamp window with bare fingers.
5. Set the spring aside.

To replace the stack or lamp

1. Discard the used lamp, stack or both as needed and rebuild with replacement part(s).
2. Drop the spring into the center of the sensor body.
3. When reinserting the lamp and electrode stack, it is essential to make sure that the lamp is fit snugly into the o-ring slot on the electrode stack – NOTE PICTURE BELOW. When inserting the lamp into the o-ring slot, it is recommended that a twisting motion is used. When properly assembled, the lamp should then be flush against the stack, and should be fully supported.



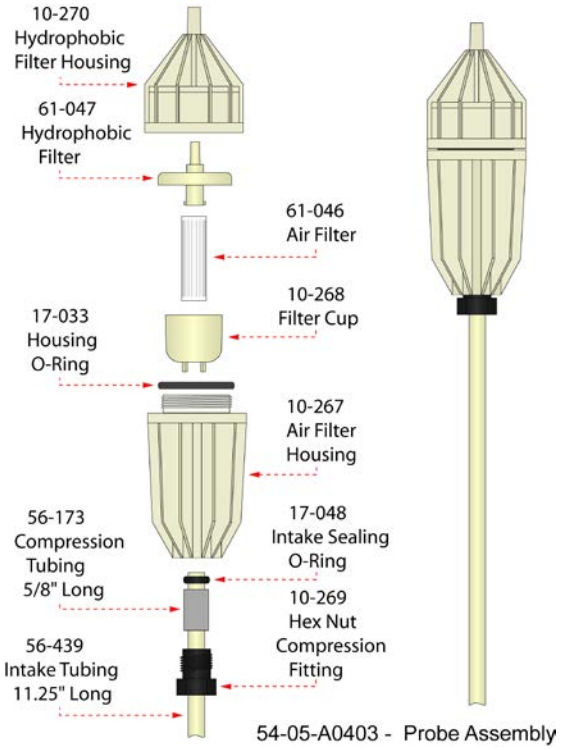
4. Snap the stack with lamp attached on to the sensor body so that the sensor is whole again and the stack cannot be removed without the removal tool.
5. The sensor should have a gasket and a filter on it. If necessary, install a sensor filter and gasket on top of the sensor.
6. Reinstall the sensor into the PHD6.
7. Reassemble the PHD6.
8. Calibrate the PID prior to use after the 5 minute warm up periods ends.

To clean the lamp

1. Follow the directions above to remove the lamp from the instrument.
2. Make sure your hands are clean.
3. Coat the cotton swab in a thin layer of lamp cleaning powder of 0.1 to 0.25 μm α-alumina.
4. Pick up the lamp with the other hand. Do not touch the top of the lamp window with bare fingers.
5. Using the cotton swab dipped in the cleaning powder, polish the top of the lamp with a swirling motion. Cleaning typically takes about 30 seconds and is finished when the swab starts to squeak.
6. Reassemble the sensor and the PHD6. See steps 2-8 above in the directions to replace the stack or lamp.

6.5 Sample probe assembly

The PHD6's sample draw probe is the standard probe assembly from Honeywell. The illustration below gives a breakdown of all parts in the sample draw probe with part numbers. The sample probe handle contains moisture barrier and particulate filters designed to remove contaminants that might otherwise harm the instrument.



Sample probe filters should be replaced whenever visibly discolored due to contamination.

CAUTION: Never perform remote sampling without the sample probe and hose assembly. The sample probe handle contains replaceable filters designed to block moisture and remove particulate contaminants. If the pump is operated without the probe assembly in place, contaminants may cause damage to the pump, sensors and internal components of the PHD6.

Particulate contaminants are removed by means of a cellulose filter. The hydrophobic filter includes a Teflon™ barrier which blocks the flow of moisture as well as any remaining particulate contaminants.

6.5.1 Changing sample probe filters

The threaded sample probe handle is accesses the filters. The particulate filter is held in place by means of a clear filter cup. To replace the particulate filter, remove the old filter and cup, insert a new filter into the cup, and slide the cup back into place in the probe handle. The hydrophobic barrier filter fits into a socket in the rear section of the probe handle. (The narrow end of the hydrophobic barrier filter is inserted towards the rear of the handle.)

To avoid accidentally introducing particulate contaminants into the system, turn the sample probe upside-down prior to removing either the hydrophobic filter or the particulate filter.

The following replacement filter kits are currently available from Honeywell:

Part No.	Kit	#Parti-culate	#Hydro-phobic
54-05-K0401	Standard	10	3
54-05-K0402	Economy	10	0
54-05-K0403	Economy	30	10
54-05-K0404	Bulk	0	25
54-05-K0405	Bulk	100	0

6.5.2 Changing sample probe tubes (wands)

The standard 11.5” long butyrate probe tube is held in place with a hex-nut compression fitting and compression sleeve. The standard probe tube can be interchanged with other custom length sections of 1/4” OD tubing, or probe tubes made of other materials (such as stainless steel).

Probe tubes are exchanged by loosening the hex-nut compression fitting, removing the old tube, sliding the compression sleeve into place around the new tube, inserting the new tube into the probe handle, then replacing and tightening the hex-nut.

Note: The sample probe must be checked for leakage (as discussed in Section 3.1.1) whenever filters or probe tubes are exchanged or replaced before being returned to service.

6.6 PHD6 Pump Maintenance

PHD6 pumps are fairly maintenance free with the exception of the replacement of the pump filters on a regular basis.

6.6.1 Replacing pump filters

1. Remove the two screws that hold the inlet port to the pump.
2. Gently pull the dust filter holder free of the pump.
3. Remove and replace the dust filter that is located in the holder.
4. The hydrophobic filter is located beneath the inlet port in the pump housing. Use a small screwdriver or other object to punch through the filter and remove it. The gasket that sits between the inlet port and the filter should come out with the filter.
5. Place the new hydrophobic filter with the filter side down in place of the one removed in step 4. The gasket should be located on top of the filter and should sit against the dust filter holder, which will be reinstalled in step 6.
6. Replace the dust filter holder (which now has a new filter in it) and secure it with the two screws removed in step 1.

Appendices

Appendix A Toxic gas measurement – Warning, Danger, STEL and TWA alarms

Many toxic substances are commonly encountered in industry. The presence of toxic substances may be due to materials being stored or used, the work being performed, or may be generated by natural processes. Exposure to toxic substances can produce disease, bodily injury, or death in unprotected workers.

It is important to determine the amounts of any toxic materials potentially present in the workplace. The amounts of toxic materials potentially present will affect the procedures and personal protective equipment that must be used. The safest course of action is to eliminate or permanently control hazards through engineering, workplace controls, ventilation, or other safety procedures. Unprotected workers may not be exposed to levels of toxic contaminants that exceed Permissible Exposure Limit (PEL) concentrations. Ongoing monitoring is necessary to insure that exposure levels have not changed in a way that requires the use of different or more rigorous procedures or equipment.

Airborne toxic substances are typically classified on the basis of their ability to produce physiological effects on exposed workers. Toxic substances tend to produce symptoms in two time frames.

Higher levels of exposure tend to produce immediate (acute) effects, while lower levels of long-term (chronic) exposure may not produce physiological symptoms for years.

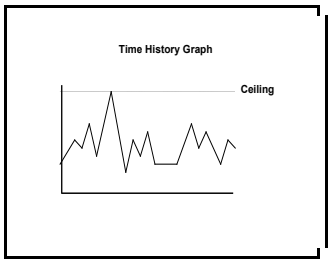
Hydrogen sulfide (H_2S) is a good example of an acutely toxic substance which is immediately lethal at relatively low concentrations. Exposure to a 1,000 ppm (parts per million) concentration of H_2S in air produces rapid paralysis of the respiratory system, cardiac arrest, and death within minutes.

Carbon monoxide (CO) is a good example of a chronically toxic gas. Carbon monoxide bonds to the hemoglobin molecules in red blood cells. Red blood cells contaminated with CO are unable to transport oxygen. Although very high concentrations of carbon monoxide may be acutely toxic, and lead to immediate respiratory arrest or death, it is the long term physiological effects due to chronic exposure at lower levels that take the greatest toll of affected workers. This is the situation with regards to smokers, parking garage attendants, or others chronically exposed to carbon monoxide in the workplace. Exposure levels are too low to produce immediate symptoms, but small repeated doses reduce the oxygen carrying capacity of the blood over time to dangerously low levels. This partial impairment of the blood supply may lead over time to serious physiological consequences.

Because prudent monitoring programs must take both time frames into account, there are two independent exposure measurements and alarm types built into the PHD6 design.

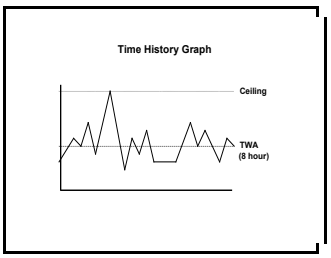
1. Warning and Danger Alarms

OSHA has assigned some, but not all, toxic substances with a ceiling level which represents the highest concentration of a toxic substance to which an unprotected worker should ever be exposed, even for a very short time. The default Warning and Danger alarm levels in the PHD6 are less than or equal to the OSHA-assigned ceiling levels for both CO and H_2S. **Never enter an environment even momentarily when concentrations of toxic substances exceed the level of either the Warning or the Danger Alarm**.



2. Time Weighted Average (TWA)

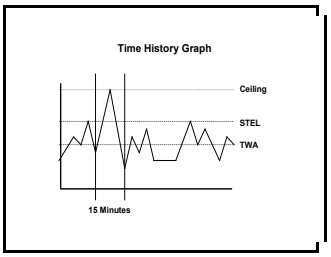
The maximum average concentration to which an unprotected worker may be exposed over an eight hour working day is called the Time Weighted Average or TWA value. TWA values are calculated by taking the sum of exposure to a particular toxic gas in the current operating session in terms of parts-per-million-hours and dividing by an eight-hour period.



3. Short Term Exposure Limits (STEL)

Toxic substances may have short term exposure limits which are higher than the eight hour TWA. The STEL is the maximum average concentration to which an unprotected worker may be exposed in any fifteen minute interval during the day. During this time, neither the eight hour TWA or the ceiling concentration may be exceeded.

Any fifteen minute periods in which the average STEL concentration exceeds the permissible eight hour TWA must be separated from each other by at least one hour. A maximum of four of these periods are allowed per eight hour shift.



Appendix B Calibration Frequency Recommendation

One of the most common questions that we are asked at Honeywell is: ***"How often should I calibrate my gas detector?"***

Sensor Reliability and Accuracy

Today's sensors are designed to provide years of reliable service. In fact, many sensors are designed so that with normal use they will only lose 5% of their sensitivity per year or 10% over a two-year period. Given this, it should be possible to use a sensor for up to two full years without significant loss of sensitivity.

Verification of Accuracy

With so many reasons why a sensor can lose sensitivity and given the fact that dependable sensors can be key to survival in a hazardous environment, frequent verification of sensor performance is paramount.

There is only one sure way to verify that a sensor can respond to the gas for which it is designed. That is to expose it to a known concentration of target gas and compare the reading with the concentration of the gas. This is referred to as a "bump" test. This test is very simple and takes only a few seconds to accomplish. **The safest course of action is to do a "bump" test prior to each day's use**. It is not necessary to make a calibration adjustment if the readings fall between 90%* and 120% of the expected value. As an example, if a CO sensor is checked using a gas concentration of 50 PPM it is not necessary to perform a calibration unless the readings are either below 45 PPM or above 60 PPM.

***The Canadian Standards Association (CSA) requires the instrument to undergo calibration when the displayed value during a bump test fails to fall between 100% and 120% of the expected value for the gas.**

Lengthening the Intervals between Verification of Accuracy

We are often asked whether there are any circumstances in which the period between accuracy checks may be lengthened.

Honeywell is not the only manufacturer to be asked this question! One of the professional organizations to which Honeywell belongs is the Industrial Safety Equipment Association (ISEA). The "Instrument Products" group of this organization has been very active in developing a protocol to clarify the minimum conditions under which the interval between accuracy checks may be lengthened.

A number of leading gas detection equipment manufacturers have participated in the development of the ISEA guidelines concerning calibration frequency. Honeywell procedures closely follow these guidelines.

If your operating procedures do not permit daily checking of the sensors, Honeywell recommends the following procedure to establish a safe and prudent accuracy check schedule for your Honeywell instruments:

1. During a period of initial use of at least 10 days in the intended atmosphere, check the sensor response daily to be sure there is nothing in the atmosphere that is poisoning the sensor(s). The period of initial use must be of sufficient duration to ensure that the sensors are exposed to all conditions that might have an adverse effect on the sensors.
2. If these tests demonstrate that it is not necessary to make adjustments, the time between checks may be lengthened. The interval between accuracy checking should not exceed 30 days.
3. When the interval has been extended the toxic and combustible gas sensors should be replaced immediately upon warranty expiration. This will minimize the risk of failure during the interval between sensor checks.
4. The history of the instrument response between verifications should be kept. Any conditions, incidents, experiences, or exposure to contaminants that might have an adverse effect on the calibration state of the sensors should trigger immediate re-verification of accuracy before further use.
5. Any changes in the environment in which the instrument is being used, or changes in the work that is being performed, should trigger a resumption of daily checking.
6. If there is any doubt at any time as to the accuracy of the sensors, verify the accuracy of the sensors by exposing them to known concentration test gas before further use.

Gas detectors used for the detection of oxygen deficiencies, flammable gases and vapors, or toxic contaminants must be maintained and operated properly to do the job they were designed to do. Always follow the guidelines provided by the manufacturer for any gas detection equipment you use!

If there is any doubt regarding your gas detector's accuracy, do an accuracy check! All it takes is a few moments to verify whether or not your instruments are safe to use.

One Button Auto Calibration

While it is only necessary to do a "bump" test to ensure that the sensors are working properly, all current gas detectors offer a one-button auto calibration feature. This feature allows you to calibrate a Honeywell gas detector in about the same time as it takes to complete a "bump" test. The use of automatic bump test and calibration stations can further simplify the tasks, while automatically maintaining records.

Don't take a chance with your life. Verify accuracy frequently!

Appendix C PHD6 Sensor Information

Part No.	Description	Range	Resolution
54-54-80	LEL Combustible Gas	0 – 100% LEL	1% LEL
54-54-90	O_2 Oxygen	0 – 30% by Volume	0.1%
54-54-01	CO Carbon Monoxide	0 – 1000 PPM	1 PPM
54-54-19	CO-H CO Minus, reduced sensitivity to H_2	0 – 1000 PPM	1 PPM
54-54-05	CO+ CO Plus dual purpose CO / H_2S (Provides a non-specific readout for CO and H_2S)	CO: 0 – 1000 PPM H_2S: 0 – 200 PPM	1 PPM
54-54-02	H_2S Hydrogen Sulfide	0 – 200 PPM	1 PPM
54-54-14	Duo-Tox Dual Channel CO/H_2S Provides substance specific readouts for CO & H_2S	CO: 0 – 1000 PPM H_2S: 0 – 200 PPM	1 PPM 1 PPM
54-54-03	SO_2 Sulfur dioxide	0 – 25 PPM	0.1 PPM
54-54-21	NH_3 Ammonia	0 – 100 PPM	1 PPM
54-54-18	Cl_2 Chlorine (specific)	0 – 50 PPM	0.1 PPM
54-54-20	ClO_2 Chlorine dioxide (specific)	0 – 5 PPM	0.01 PPM
54-54-06	NO Nitric oxide	0 – 350 PPM	1 PPM
54-54-09	NO_2 Nitrogen dioxide	0 – 50 PPM	0.1 PPM
54-54-23	HCN Hydrogen cyanide	0 – 100 PPM	0.2 PPM
54-54-13	PH_3 Phosphine	0 – 20 PPM	0.1 PPM
54-54-50	NDIR CO_2 Carbon dioxide	0 – 5.00%/vol.	0.025%*
54-54-51	NDIR CH_4 Methane	0 – 5.00%/vol.	0.05%
54-54-52	PID Volatile Organic Compound (VOCs)	0 – 3000 PPM	.1PPM

*The CO_2 sensor has an internal resolution of 0.025% but displays readings rounded to the nearest 0.01%. It will, therefore, display steps of 0.03%, 0.05%, 0.08%, 0.10%, etc.

Appendix D Electrochemical Toxic Sensor Cross-Sensitivity

The table below provides the cross-sensitivity response of the PHD6 electrochemical toxic gas sensors to common interference gases. The values are expressed as a percentage of the primary sensitivity, or the reading of the sensor when exposed to 100ppm of the interfering gas at 20ºC. These values are approximate. The actual values depend on the age and condition of the sensor. Sensors should always be calibrated to the primary gas type. Cross-sensitive gases should not be used as sensor calibration surrogates without the express written consent of Honeywell.

SENSOR	CO	H2S	SO2	NO	NO2	Cl2	ClO2	H2	HCN	HCl	NH3	C2H4	C2H2
Carbon Monoxide (CO)	100	10	5	10	-15	-5	-15	50	15	3	0	75	250
Carbon Monoxide (CO+)	100	350	50	30	-60	-60	-120	50	n/d	n/d	0	75	250
Carbon Monoxide (CO-H)	100	2	0.5	3	-0.5	-0.5	-1.5	5	n/d	n/d	0.1	35	(+)
Hydrogen Sulfide (H2S)	0.5	100	20	2	-20	-20	-60	0.2	0	0	0	n/d	n/d
Sulfur Dioxide (SO2)	1	0	100	<8	-100	-70	-150	0.2	n/d	n/d	<0.1	15	100
Nitrogen Dioxide (NO2)	<0.1	-40	-2.5	<0.5	100	100	270	<0.1	n/d	n/d	<0.1	n/d	0.1
Nitric Oxide (NO)	0.1	**≤15**	**≤10**	100	**≤30**	15	n/d	0.1	n/d	n/d	n/d	n/d	n/d
Chlorine (Cl2) (specific)	0	-3	<1	n/d	12	100	20	0	0	0	0	0	0
Chlorine (Cl2) (non-specific)	0	-20	<5	0	120	100	300	0	n/d	n/d	0	n/d	n/d
Chlorine Dioxide (ClO2) (specific)	0	-25	-5	n/d	n/d	60	100	0	0	0	n/d	0	0
Chlorine Dioxide (ClO2) (non-specific)	0	-7	<2	0	40	<35	100	0	n/d	n/d	0	n/d	n/d
Ammonia (NH3)	<1	<10	2	n/d	0	0	n/d	0	0	0	100	0	0
Phosphine (PH3)	0.5	25	20	n/d	(-)	(-)	(-)	0.1	n/d	n/d	n/d	1	0.5
Hydrogen Cyanide (HCN) (old style 54-54-10)	0.5	200	100	-5	-70	-50	-150	0	100	65	-5	0	n/d
Hydrogen Cyanide (HCN) (new style 54-54-23)	0	0**	n/d	n/d	-70	n/d	n/d	0	100	n/d	n/d	n/d	n/d

** Sensor manufacturer rates Cross Sensitivity for (54-54-23) HCN sensor to H2S as follows for 20 PPM exposure at 20°C: “Short gas exposure in minute range; after filter saturation: ca. 40 PPM reading”.

n/d = no data

Honeywell Warranty Gas Detection Products

General

Honeywell warrants gas detectors, sensors and accessories manufactured and sold by Honeywell, to be free from defects in materials and workmanship for the periods listed in the tables below.

Damages to any Honeywell products that result from abuse, alteration, power fluctuations including surges and lightning strikes, incorrect voltage settings, incorrect batteries, or repair procedures not made in accordance with the Instrument's Reference Manual are not covered by the Honeywell warranty.

The obligation of Honeywell under this warranty is limited to the repair or replacement of components deemed by the Honeywell Instrument Service Department to have been defective under the scope of this standard warranty. To receive consideration for warranty repair or replacement procedures, products must be returned with transportation and shipping charges prepaid to Honeywell, or to a Honeywell Authorized Warranty Service Center. It is necessary to obtain a return authorization number from Honeywell prior to shipment.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. HONEYWELL WILL NOT BE LIABLE FOR LOSS OR DAMAGE OF ANY KIND CONNECTED TO THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

Instrument & Accessory Warranty Periods

PHD6™	2 years from date of purchase
ToxiPro®, MultiPro™	2 years from date of purchase
Battery packs and chargers, sampling pumps and other components, which by their design are consumed or depleted during normal operation, or which may require periodic replacement	One year from the date of purchase

Sensor Warranty Periods

PHD6™, Cannonball*3*™, Multi Vision™, MultiPro™, Toxi Vision™, ToxiPro®	O_2, LEL**, CO, CO+, H_2S & Duo-Tox	2 Years
	All Other Sensors	1 Year
All Others	All Sensors	1 Year

**** Damage to combustible gas sensors by acute or chronic exposure to known sensor poisons such as volatile lead (aviation gasoline additive), hydride gases such as phosphine, and volatile silicone gases emitted from silicone caulks/sealants, silicone rubber molded products, laboratory glassware greases, spray lubricants, heat transfer fluids, waxes & polishing compounds (neat or spray aerosols), mold release agents for plastics injection molding operations, waterproofing formulations, vinyl & leather preservatives, and hand lotions which may contain ingredients listed as cyclomethicone, dimethicone and polymethicone (at the discretion of Honeywells' Instrument Service department) void Honeywells' Standard Warranty as it applies to the replacement of combustible gas sensors.**

DOC022.97.80041

2100Q and 2100Q*is*

04/2013, Edition 2



Basic User Manual
Manuel d'utilisation de base
Manual básico del usuario
Manual Básico do Usuário
基本用户手册
基本取扱説明書
기본 사용 설명서

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Specifications

Specifications are subject to change without notice.

Specification	Details
Measurement method	Ratio turbidimetric determination using a primary nephelometric light scatter signal (90°) to the transmitted light scatter signal.
Regulatory	**2100Q:** Meets EPA Method 180.1 **2100Q*is*:** Meets ISO 7027
Lamp source	**2100Q:** Tungsten filament lamp **2100Q*is*:** Light-emitting diode (LED) at 860 nm
Range	0–1000 NTU (FNU)
Accuracy	±2% of reading plus stray light from 0–1000 NTU (FNU)
Repeatability	±1% of reading or 0.01 NTU (FNU), whichever is greater
Resolution	0.01 NTU on lowest range
Stray light	≤ 0.02 NTU (FNU)
Signal averaging	Selectable on or off
Detector	Silicon Photodiode
Reading modes	Normal (Push to Read), Signal Averaging or Rapidly Settling Turbidity™
Calibration options	Single step RapidCal™ for Low-Level Regulatory Reporting from 0–40 NTU (FNU) Full range calibration from 0–1000 NTU (FNU) Calibration to degrees of turbidity
Calibration logger	Records the last 25 successful calibrations
Verification logger	Logs the last 250 successful verifications
Data logger	500 records
Power requirement	AC 100–240 V , 50/60 Hz (with power or USB/power module) 4 AA alkaline batteries Rechargeable NiMH (for use with USB/power module)
Operating conditions	Temperature: 0 to 50 °C (32 to 122 °F) Relative Humidity: 0–90% at 30 °C, 0–80% at 40 °C, 0–70% at 50 °C, noncondensing
Storage conditions	–40 to 60 °C (–40 to 140 °F), instrument only
Interface	Optional USB
Sample required	15 mL (0.5 oz.)
Sample cells	Round cells 60 x 25 mm (2.36 x 1 in.) borosilicate glass with screw caps
Dimensions	22.9 x 10.7 x 7.7 cm (9.0 x 4.2 x 3.0 in.)
Weight	530 g (1.17 lb) without batteries 620 g (1.37 lb) with four AA alkaline batteries
Meter enclosure rating	IP67 (closed lid, battery and module compartment excluded)
Protection class	Power supply: Class II
Certification	CE certified
Warranty	1 year (EU: 2 years)

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*

Certification

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.

2. The equipment must accept any interference received, including interference that may cause undesired operation.

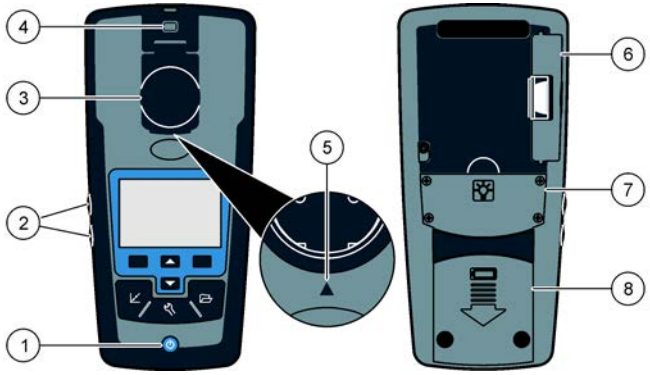
Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Product overview

The 2100Q and 2100Q*is* portable turbidimeters measure turbidity from 0 to 1000 NTU (FNU). Primarily for field use, the portable meter operates on four AA batteries. Data can be stored and transferred to a printer, computer or USB storage device.

Figure 1 Product overview

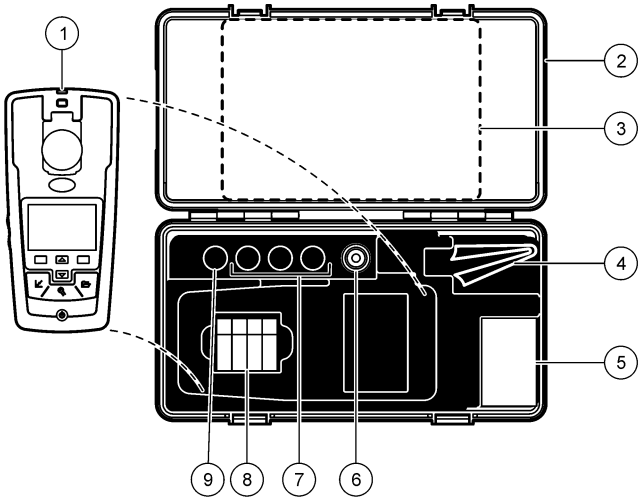


1	Power on or off	**5**	Alignment arrow
2	Backlight keys (+ and -)	**6**	Module
3	Sample cell holder with lid	**7**	Lamp compartment
4	Attachment for lanyard	**8**	Battery compartment

Product components

Refer to Figure 2 to make sure that all components have been received. If any of these items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 2 2100Q and 2100Q*is* components



1 2100Q or 2100Q*is* turbidimeter	**6** Silicone oil
2 Carrying case	**7** 20, 100 and 800 NTU StablCal calibration standards
3 User manual and Quick reference guide	**8** AA alkaline batteries (pk/4)
4 Oiling cloth	**9** StablCal 10 NTU verification standard
5 1" sample cell (10 mL) with cap (pk/6)	

Installation

⚠ CAUTION

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Install the battery

⚠ WARNING

Explosion hazard. An expired battery can cause hydrogen gas buildup inside the instrument. Replace the battery before it expires. Do not store the instrument for long periods with a battery installed.

⚠ WARNING

Potential fire hazard. Use only alkaline or nickel metal hydride batteries (NiMH) in the meter. Other battery types or incorrect installation can cause a fire. Never mix battery types in the meter.

NOTICE

The battery compartment is not waterproof. If the battery compartment becomes wet, remove and dry the batteries and dry the interior of the compartment. Check the battery contacts for corrosion and clean them if necessary.

NOTICE

When using nickel metal hydride (NiMH) batteries, the battery icon will not indicate a full charge after freshly charged batteries have been inserted (NiMH batteries are 1.2 V versus 1.5 V for alkaline batteries). Even though the icon does not indicate complete charge, 2300 mAH NiMH batteries will achieve 90% of instrument operation lifetime (before recharge) versus new alkaline batteries.

NOTICE

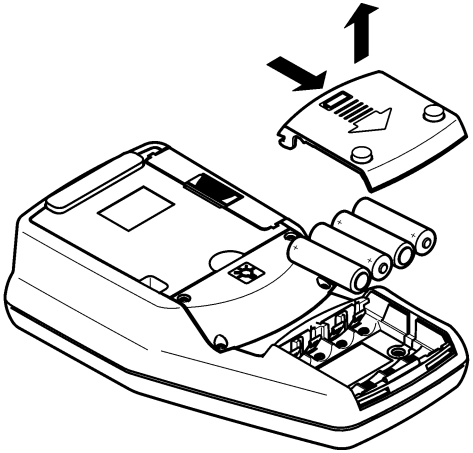
To avoid potential damage to the meter from battery leakage, remove the meter batteries prior to extended periods of non-use.

The meter can be powered with AA alkaline or rechargeable NiMH batteries. To conserve battery life, the meter will power off after 10 minutes of inactivity, the backlight powers off after 30 seconds. This time can be changed in the Power Management menu.
Note: *Rechargeable batteries will only be recharged with the USB/power module. Refer to the module documentation for further information.*

For battery installation refer to Figure 3.

1. Remove the battery cover.
2. Install 4 AA alkaline or 4 AA nickel metal hydride (NiMH) batteries. Make sure that the batteries are installed in the correct orientation.
3. Replace the battery cover.

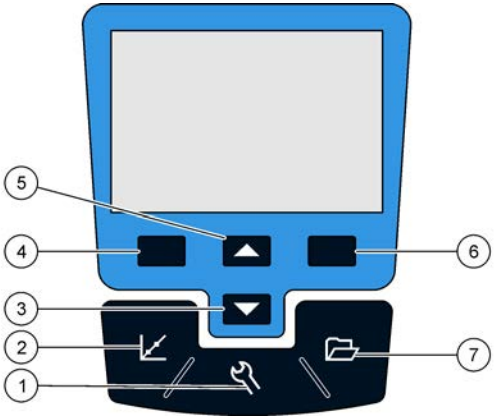
Figure 3 Battery installation



User interface and navigation

User interface

Figure 4 Keypad description

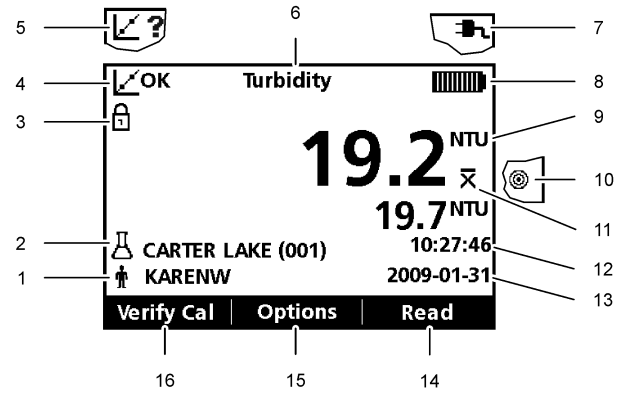


1 **SETTINGS** key: select menu options for setting up the meter	5 **UP** key: scroll through menus, enter numbers and letters
2 **CALIBRATION** key: shows calibration screen, start calibration, select cal options	6 **RIGHT** key (contextual): read turbidity sample, selects or confirms options, opens/jumps to sub-menus
3 **DOWN** key: scroll through menus, enter numbers and letters	7 **DATA MANAGEMENT** key: view, delete or transfer stored data
4 **LEFT** key (contextual): access for calibration verification, cancels or exits the current menu screen to the previous menu screen	

Display description

The measurement screen shows the turbidity, unit, calibration status, date and time, operator ID (if setup) and sample ID (if setup). Refer to Figure 5.

Figure 5 Single screen display



1 Operator identification	**9** NTU (Nephelometric Turbidity Unit) or FNU (Formazin Turbidity Unit)
2 Sample identification	**10** Reading mode: Rapidly Settling Turbidity (Target icon)
3 Stability or display lock indicator	**11** Reading mode: Signal Average (X-bar icon)
4 Calibration status indicator (Calibration OK=pass)	**12** Time
5 Calibration status indicator (Calibration ?=fail)	**13** Date
6 Parameter title	**14** Read (contextual: OK, Select)
7 AC power icon	**15** Options (contextual)
8 Battery icon	**16** Verification calibration

Navigation

The meter contains a Settings menu, Reading Options menu, Calibration Options menu and Calibration Verification Options menu to change various options. Use the **UP** and **DOWN** keys to highlight different options. Push the **RIGHT** key to select an option. There are two ways to change options:

1. Select an option from a list: Use the **UP** and **DOWN** keys to select an option. If check boxes are shown, more than one option can be selected. Push the **LEFT** key under Select.

   Note: *To deselect check boxes, push the **LEFT** key under Deselect.*
2. Enter an option value using the arrow keys:
   Push the **UP** and **DOWN** keys to enter or change a value.
3. Push the **RIGHT** key to advance to the next space.
4. Push the **RIGHT** key under **OK** to accept the value.

Startup

Turn the meter on and off

Push the **ON/OFF** key to turn on or turn off the meter. If the meter does not turn on, make sure that the batteries, or the module, are properly installed or that the AC power supply is properly connected to an electrical outlet.

Note: *The Auto-Shutoff option can also be used to turn off the meter. Additional information is available on the manufacturer's website.*

Change the language

There are three options to set the language:

- The display language is selected when the meter is powered on for the first time.
- The display language is selected when the power key is pushed and held.
- The language can be changed from the Settings menu.

1. Select a language from the list. Confirm with **OK**.
2. Push **Done** when the update is complete.

Change the date and time

The date and time can be changed from the Date & Time menu.

1. Push the **SETTINGS** key and select Date & Time.
2. Update the time and date information:

Option	Description
Format	Select one of the formats for the date and time: yyyy-mm-dd 24h yyyy-mm-dd 12h dd-mm-yyyy 24h dd-mm-yyyy 12h mm/dd/yyyy 24h mm/dd/yyyy 12h
Date	Enter the current date
Time	Enter the current time

The current date and time will be shown on the display.

After the date and time setup, the meter is ready to take a reading.

Standard operation

Use a sample ID

The sample ID tag is used to associate readings with a particular sample location. If assigned, stored data will include this ID.

1. Select **Sample ID** in the Settings menu.
2. Select, create or delete a sample ID:

Option	Description
Current ID	Select an ID from a list. The current ID will be associated with sample data until a different ID is selected.
Create a New Sample ID	Enter a name for a new sample ID.
Delete Sample ID	Delete an existing sample ID.

Use an operator ID

The operator ID tag associates readings with an individual operator. All stored data will include this ID.

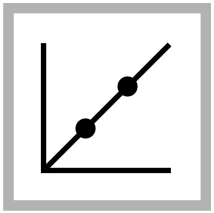
1. Select **Operator ID** in the Settings menu.
2. Select, create or delete an operator ID:

Option	Description
Current ID	Select an ID from a list. The current ID will be associated with sample data until a different ID is selected.
Create a New Operator ID	Enter a name for a new operator ID (maximum 10 names can be entered).
Delete Operator ID	Delete an existing operator ID.

Advanced operation

Calibrate the turbidimeter with StablCal® Standards

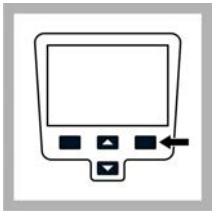
Note: *For best accuracy use the same sample cell or four matched sample cells for all readings during calibration. Insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment.*



1. Push the **CALIBRATION** key to enter the Calibration mode. Follow the instructions on the display.
Note: *Gently invert each standard before inserting the standard.*



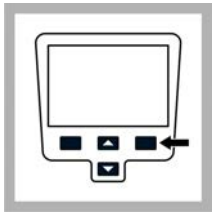
2. Insert the 20 NTU StablCal Standard and close the lid.
Note: *The standard to be inserted is bordered.*



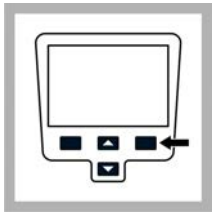
3. Push **Read**. The display shows Stabilizing and then shows the result.



4. Repeat Step 2 and 3 with the 100 NTU and 800 NTU StablCal Standard.
Note: *Push **Done** to complete a 2 point calibration.*



5. Push **Done** to review the calibration details.



6. Push **Store** to save the results.
After a calibration is complete, the meter automatically goes into the Verify Cal mode. Additional information is available on the manufacturer's website.

Reading modes

1. Push the **UP** or **DOWN** key to enter the Reading Options menu.
2. Select Reading Mode to select one of the following options:

Option	Description
Normal (Default setting)	The normal mode reads and averages three readings. The result is shown after the reading.

Option	Description
Signal Average 	The Signal Average mode compensates for reading fluctuations caused by drifting of sample particles through the light path. The X-bar icon is shown on the display when signal averaging is on. The Signal Average mode measures 12 times and starts to show the average after three readings. The final result is the average of all 12 readings.
Rapidly Settling Turbidity™ (RST) 	The Rapidly Settling Turbidity (RST) mode calculates and continuously updates the turbidity reading of the sample to a confidence of 95%, based on the accumulated trend of the real time measured values. The RST mode is best used on samples that settle rapidly and continuously change in value. The reading is based on a correctly prepared sample that is homogeneous at the beginning of the reading. It is best applied to samples that are greater than 20 NTU. The sample must be mixed thoroughly by inversion immediately before inserting it into the meter. The target icon is shown on the display when the Rapidly Settling Turbidity is on. The Rapidly Settling Turbidity reads and calculates five readings while showing intermediate results.

Maintenance

⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Clean the meter

The meter is designed to be maintenance-free and does not require regular cleaning for normal operation. Exterior surfaces of the meter may be cleaned as necessary.

Note: *Do not clean the meter with solvents to avoid damaging the material.*

1. Clean the meter with a dust- and lint-free dry or slightly damp cloth. A mild soap solution can also be used for liposoluble contamination.

Apply silicone oil to a sample cell

Sample cells and caps must be extremely clean and free from significant scratches. Apply a thin coating of silicone oil on the outside of the sample cells to mask minor imperfections and scratches that may contribute to light scattering.

Note: *Use only the provided silicone oil. This silicone oil has the same refractive index as the sample cell glass.*



1. Clean the inside and outside of the cells and caps by washing with a laboratory glass cleaning detergent. Follow with multiple rinses with distilled or demineralized water.



2. Apply a small bead of silicone oil from the top to the bottom of the cell.



3. Use the provided oiling cloth to spread the oil uniformly. Wipe off the excess so that only a thin coat of oil is left. Make sure that the sample cell is almost dry with little or no visible oil.

Note: *Store the oiling cloth in a plastic storage bag to keep the cloth clean.*

Store the sample cells

NOTICE

Do not air dry the sample cells.

Note: *Always store the sample cells with caps on to prevent the cells from drying.*

1. Fill the sample cells with distilled or demineralized water.
2. Cap and store the sample cells.
3. Wipe the outside of the sample cells dry with the a soft cloth.

Replace the battery

⚠ WARNING



Explosion hazard. An expired battery can cause hydrogen gas buildup inside the instrument. Replace the battery before it expires. Do not store the instrument for long periods with a battery installed.

⚠ WARNING

Potential fire hazard. Use only alkaline or nickel metal hydride batteries (NiMH) in the meter. Other battery types or incorrect installation can cause a fire. Never mix battery types in the meter.

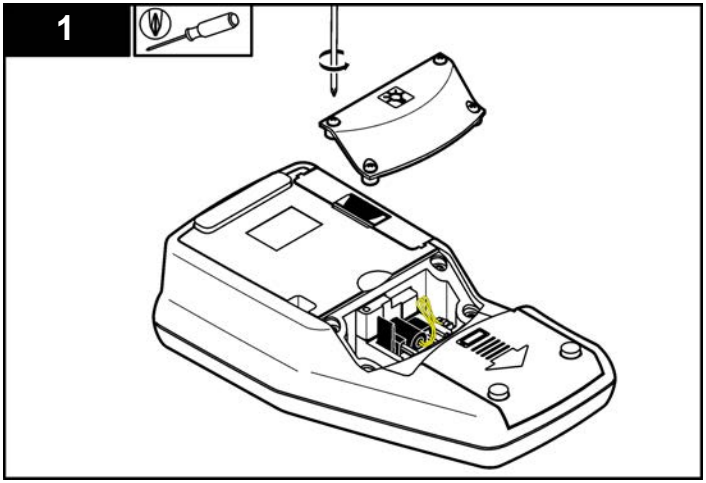
For battery replacement refer to Install the battery on page 6.

1. Remove the battery cover.
2. Remove the batteries.
3. Install 4 AA alkaline or 4 AA nickel metal hydride (NiMH) batteries. Make sure that the batteries are installed in the correct orientation.
4. Replace the battery cover.

Replace the lamp

⚠ CAUTION

Burn Hazard. Wait until lamp cools down. Contact with the hot lamp can cause burns.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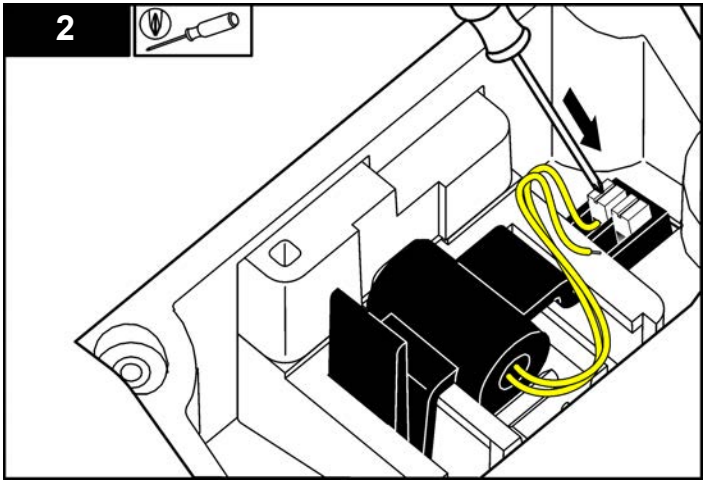
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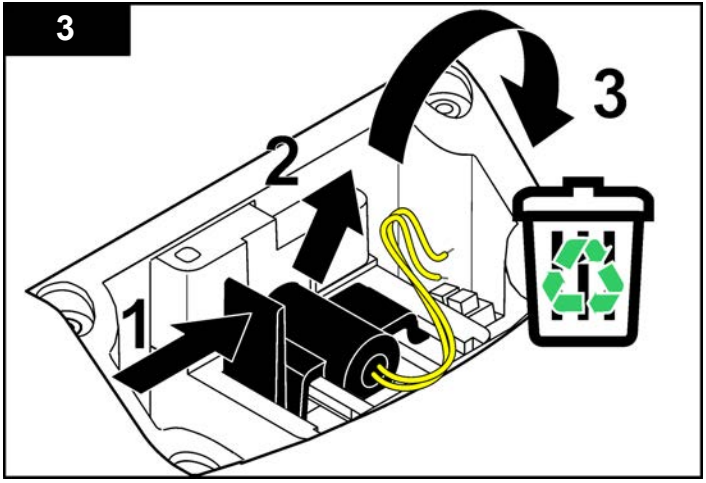
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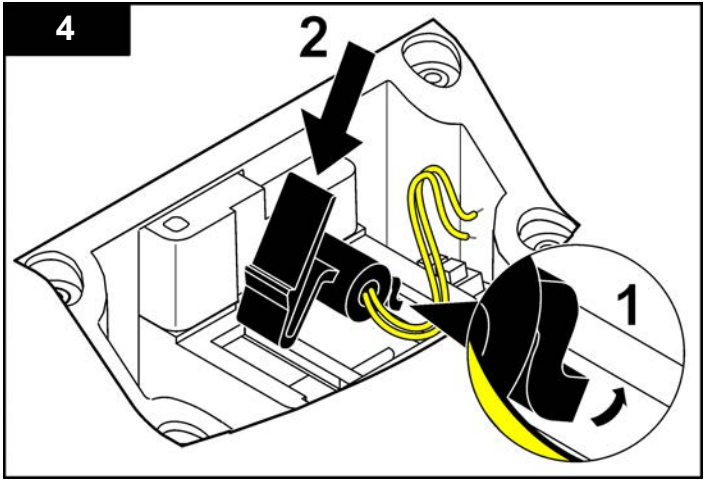
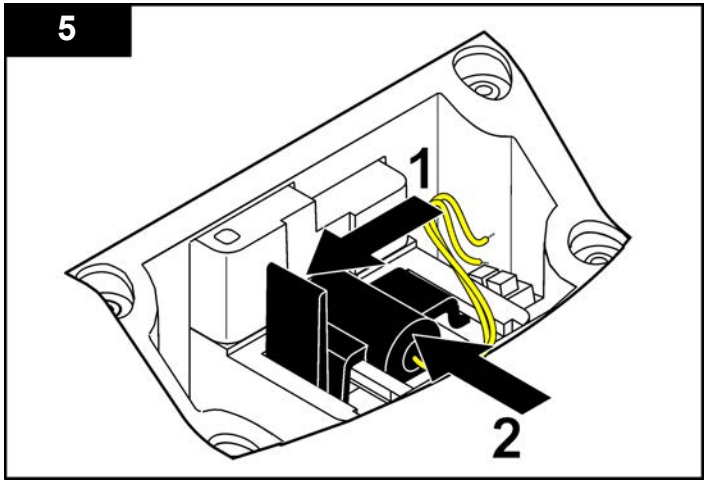
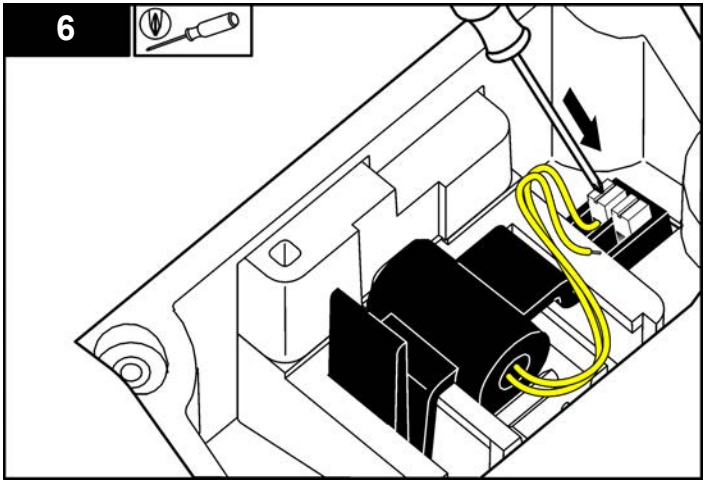
2
1


4
2
1


5
1
2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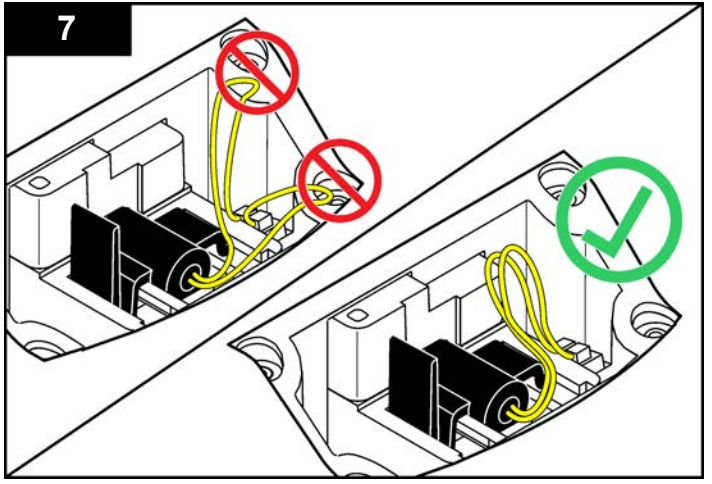
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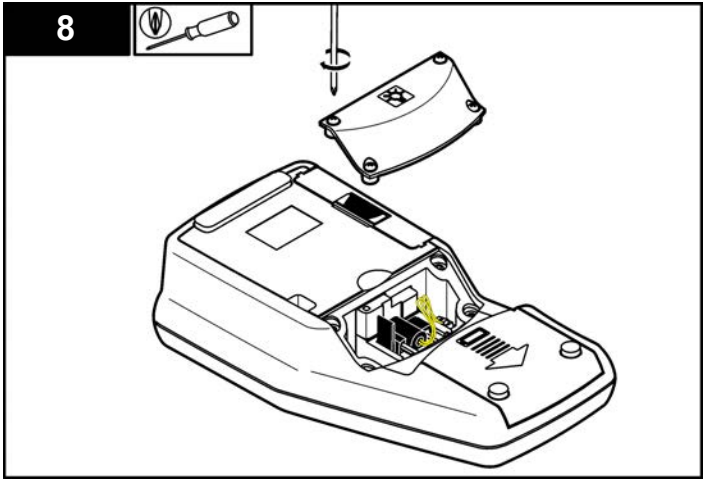

8

Troubleshooting

Refer to the following table for common problem messages or symptoms, possible causes and corrective actions.

Error/Warning	Description	Solution
Close lid and push Read.	The lid is open or lid detection failed.	Make sure that the lid is closed during reading and re-read.
Low Battery!	Battery is low.	• Insert new batteries • Connect USB/power module if rechargeable batteries are used
ADC Failure!	Hardware error causing reading to fail.	Repeat the reading.
Detector signal too low!	Insufficient light on the 180° detector.	• Check for obstructed light path. • Check the lamp.
Overrange!	Turbidity too high-caused probably by calibrating with RapidCal™ only.	• Calibrate the upper range. • Dilute the sample.
Underrange!	The measured absorbance is below the calibration range.	Repeat calibration
Please check the lamp!	Signals are too low on the 90° and 180° detector.	**2100Q:** The lamp is defective. Change the lamp (refer to Replace the lamp on page 12). **2100Q*is*:** Contact technical support.
Temperature too high! Switch off instrument.	Temperature has exceeded the meter limits (>60 °C or >140 °F).	Turn off the meter and let it cool down.
RST: Average value!	Solids are settling too slowly. The reading mode is not suitable for this sample.	Select Normal or Signal Average reading mode.
Confidence level is < 95%	The reading mode Rapidly Settling Turbidity did not meet the range of ≥ 95% confidence.	• Invert the sample several times so that the solids allocate. Repeat the reading again. • Switch to the Normal reading mode if the sample is stable and does not have settable solids.
Standard value out of range. Insert standard and push Read	Used incorrect standard value for the reading.	Insert the appropriate standard and read again.
ID already in use. Enter new ID	The Operator or Sample ID is unavailable as it is already assigned.	Create a new ID.
Error - Security Please set password before activating security	No password is created.	Create a new password.
Please enter at least one character.	Password must contain minimum of one character.	Create a password of at least one character.
Password incorrect. Please retry.	Incorrect password was entered.	Enter the appropriate password.

Error/Warning	Description	Solution
Please disconnect the USB cable from your computer.	Data storage does not respond while connected to the meter and the computer.	Disconnect the USB cable from the meter and try sending data again.
USB module memory full. Delete data and try again.	Data storage is full.	**1.** Connect USB/power module to the computer. **2.** Download the stored data to the computer. **3.** Delete Data Log on the module.
Delete Last Reading Failed!	Error in the data storage.	Turn the meter off and on. If the error message still occurs, contact technical support.
Delete Data Log failed!		
Can't read data set!		
Can't store data!		
Can't store to the Reading Log!		
Can't store to the Verify Cal Log!		
Error storing data!		
Error reading data!		

Appendix C: Field Data Sheets and Chain of Custody Forms

Form DW1 – Dry Weather Outfall Investigation Form

Form DW2 – Trash Assessment Form

Chain-of-Custody Form – Boise City Water Quality Laboratory

Chain-of-Custody Form – Analytical Labs, Inc.

Form DW-1
DRY WEATHER OUTFALL INVESTIGATION FORM

Outfall Information

Outfall ID: _____

Station Type: _Outfall_ **Location:** _____

Lat: _____ **Lon:** _____ **Receiving Water**: _____

Station Config.: (circle one) Box culvert Circular DI structure Elliptical Manhole Open ditch, lined Open ditch, unlined

Material: (circle one) ADS CMP Concrete Earthen PVC Rip rap RCP SMP **Size**: _____ (Inches)

Comments: _____

_____

_____

_____

Drainage Area (acres): _____ **Land Use:** _____

Site Condition Information

Personnel: _____ **Date/Time On-site:** _____ MDT / MST

Comments: _____

_____

_____

_____

Field Quantitative Results

Component

Antecedent Dry Conditions Met: **Y / N** (see notes for clarification)

Previous Storm Date: _____ Storm Total: _____ inches

Flow Depth: _____ inches Flow Width: _____ inches

Velocity (Flow Probe): _____ fps Flow: _____ cfs

Velocity (Bucket Method) volume used: (circle one) 500ml 1L 5 gallon

Bucket Method Trial: 1: _____, 2: _____, 3: _____ sec.

Flow: _____ cfs (see notes for flow calculation resource)

Component

Temperature – DO Meter: _____ C

Dissolved Oxygen: _____ mg/L

Conductivity: _____ uS

pH: _____S.U. pH temp:_____ C

Total Chlorine: _____ mg/L

Total Copper: _____ mg/L

Phenols: _____ mg/L

Turbidity: _____ NTU

Notes: Antecedent dry conditions require >72 hours of < 0.10 inches of precipitation.
Flow Calculator - \\APPWSUS\ACHDFiles\Groups\ROWDS\STORMWATER\OUTFALL INSPECTION\DWOS\Dry WX Flow Calcs_151123

Form DW-1
DRY WEATHER OUTFALL INVESTIGATION FORM

Sample Collection Information

Component	Initial Grab Sample Date/Time	*QC-__A__ Field Duplicate* *(fill in appropriate sequential number)* Date/Time	QC-__B__ Field Blank *(fill in appropriate sequential number)* Date/Time	Labeled
E. coli - 250mL sterile plastic				☐
TSS – 5L plastic				☐
TP – 500mL plastic				☐
Detergents – 500mL plastic				☐
Ortho-P – 500mL sterile plastic *(To be filtered)*				☐
Ortho-P – 250mL sterile plastic *(Filtered Sample)*				☐

Notes: Date/Time recorded on the Lab COC for QC samples will be the collection date at 12:00. Field Blanks will be filled with ultra-pure water from WQL.

Investigation Event Qualitative Results

Observed?	Component	Comments/Description (circle one, if appropriate)				
☐	**GPS**					
☐	**Photos**					
☐	**Sedimentation**					
☐	**Staining**	Oily	Flow line	Paint		
☐	**Flow observed**	Trickle	Moderate	Substantial		
☐	**Odor**	Sewage	Sulfide	Rancid/Sour	Petroleum	
	Color	Clear	Green	Brown	Orange	Other
☐	**Vegetation**	Excessive	Inhibited			
☐	**Floatables** (trash NOT included)	Sewage	Suds	Petroleum		
	Structural condition	Good	Fair	Poor		
	Clarity	Clear	Cloudy	Silty		
	Illicit discharge	Unlikely	Potential	Obvious		
	Trash observed	No	Yes – see Trash Assessment Form (Form 2)			

Date/Time Off-site: _____ MDT / MST (circle one)

Investigation Event Qualitative Results (determined in office, post-inspection)

Component	Comments/Description (circle one)	
Compliance status	IN compliance	OUT of compliance

FORM DW-2
TRASH ASSESSMENT FORM

Outfall Information

Outfall ID: _____

Station Type: Outfall **Location:** _____

Lat: _____ **Lon:** _____ **Receiving Water:** _____

Comments: _____

_____

_____

Personnel: _____

Date/Time On-site: _____ MDT / MST (circle one) Note: This is the "Start Date/Time"

Component	Value	Unit
Antecedent dry period	_____	**Hours**
Total precipitation - previous storm	_____ **Inches**	**Result/Analysis Date:** _____

Trash Evaluation Includes: ☐ MS4 ☐ Receiving Water ☐ Both

Component	Observed? (check (✓) if yes)	Comments/Description (circle one, if appropriate)
Photos	☐	_____
Trash observed	☐	Optimal – No trash observed on first glance. Close examination yields <10 pieces.
	☐	Suboptimal- On first glance, little or no trash observed. Close examination yields 10-50 pieces.
	☐	Marginal – Trash evident in low to medium levels (51-100 pieces).
	☐	Sub marginal – Trash distracts the eye on first glance. Litter and debris >100-400 pieces. Evidence of human use apparent: cans, bottles, clothes, food wrappers, blankets.
	☐	Poor – Site is significantly impacted by trash. Evidence of excessive dumping. Littler observed >400 pieces.

FORM DW-2
TRASH ASSESSMENT FORM

Type of Trash	*Rank 1, Most - 12, Lest	Potential Route (check up to 2)				Potential Source (check up to 2)						
		Dumping	Littering	Upstream	Unable to Determine	Household	Construction	Commercial	Industrial	School	Transient	Unable to Determine
Automotive												
Biohazard												
Business												
Cigarette Butts												
Construction												
Fabric/Clothing												
Food Packaging												
Food Waste												
Household												
Shopping Cart												
Toxic												
Yard Waste												

*Only rank types of trash present in evaluated area from 1 through 12 (1 is most prevalent, 12 is least prevalent).Do not rank types of trash that are not present in evaluated area.

Comments:_____

_____

_____

_____

_____

_____

Date/Time Off-site:_____ MDT / MST (circle one)

Ada County Highway District

Attn: Adam Van Patten
3775 Adams Street
Garden City, Idaho 83714–6418
Tel. (208) 387–6268
Fax (208) 387–6391
Purchase Order:
Project: DWOS
Sampler(s):

Lab#	Begin Date	End Date	Begin Time	End Time	Sample Identification	Matrix: Water	Type: Grab	Type: Composite	BOD_5—SM 5210B	COD—Hach 8000	TSS—SM 2540D	TDS—SM 2540C	TKN—PSTORP PAI-DK01	TP—EPA 200.7	Orthophosphate—EPA 365.1	Oil & Grease—EPA 1664	Total As, Cd, Cu, Pb, Hg, Ni, Zn, Cr—EPA 200.7	Diss. Cd, As, Cu, Pb, Hg, Ni, Cr —EPA 200.8	Hardness—SM 2340B	E. Coli—SM 9213D	D.O.—4500 – O G	NO_3+NO_2 / NO_2—EPA 353.2	NH_3—SM 4500 NH_3 - F	Split 2L each Unless specified: TrPH—1664 A SGT HEM	Organochlorine Pest.—EPA 8081	Organophosphate Pest.—EPA 8141	BNA—EPA 8270	VOCs — EPA 8260	Number of Containers
						X	X				X			X	X					X									4

Relinquished by (sign)	Date & Time Transferred	Received by (sign)	Comments/Special Instructions:

CLIENT CODE=

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION:		PROJECT INFORMATION:
Project Manager:		**Project Name:** DWOS
Company: Ada County Highway District		**PWS Number:**
Address: 3775 Adams Street		**Purchase Order Number:**
Garden City, ID 83714		**Required Due Date:**
Phone:	**Fax:**	**E-mail Address:**
Sampled by: *(Please print)*	**Transported by:** *(Please print)*	

ANALYTICAL LABS, INC.
1804 N. 33rd Street • Boise, ID 83703
(208) 342-5515 • Fax: (208) 342-5591 • 1-800-574-5773
Website: www.analyticallaboratories.com
E-mail: ali@analyticallaboratories.com

TESTS REQUESTED

Lab ID	Date Sampled	Time Sampled	Sample Description (Source)	Sample Matrix	Remarks:
				Water	

Invoice to: *(If different than above address)*

Special Instructions:

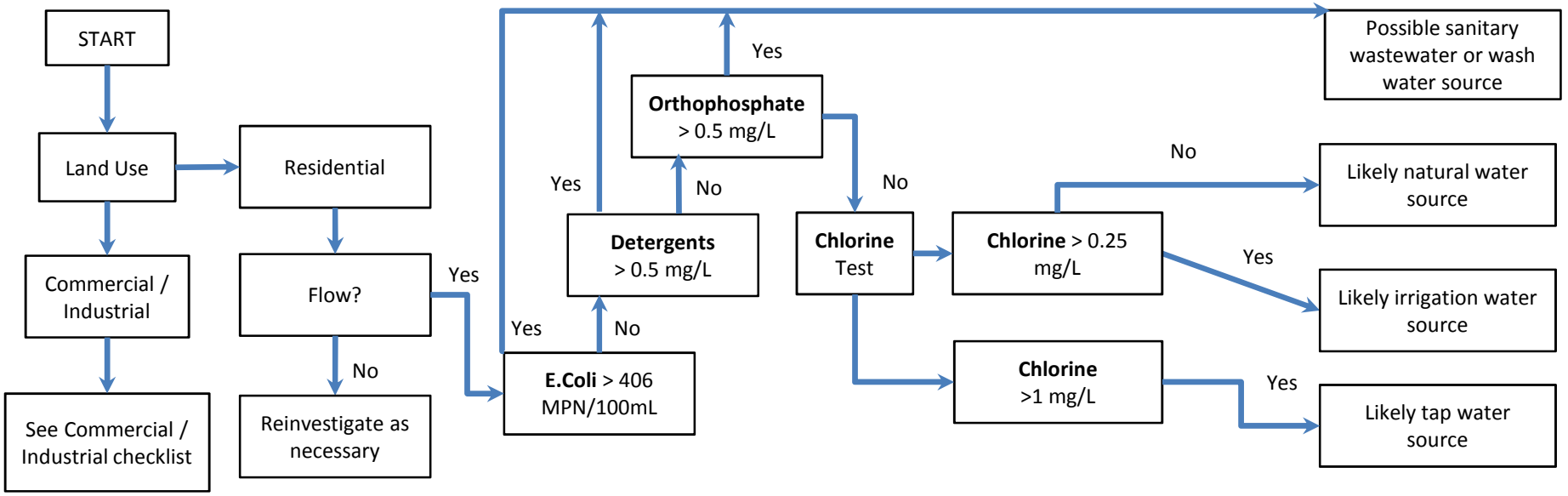
ALLOCATIONS OF RISK: Analytical Laboratories, Inc. will perform preparation and testing services, obtain findings and prepare reports in accordance with Good Laboratory Practices (GLP). If, for any reason, Analytical Laboratories, Inc. errors in the conduct of a test or procedure their liability shall be limited to the cost of the test or procedure completed in error. Under no circumstance will Analytical Laboratories, Inc. be liable for any other cost associated with obtaining a sample or use of data.

Note: Samples are discarded 21 days after results are reported. Hazardous samples will be returned to client or disposed of at client expense.

Relinquished By: *(Signature)*	**Print Name:**	**Company:** ACHD	**Date:**	**Time:**
Received By: *(Signature)*	**Print Name:**	**Company:**	**Date:**	**Time:**
Relinquished By: *(Signature)*	**Print Name:**	**Company:**	**Date:**	**Time:**
Received at Laboratory By: *(Signature)*	**Print Name:**	**Company:** **Analytical Laboratories**	**Date:**	**Time:**
SAMPLE RECEIPT **Total # of Containers:**	**Chains of Custody Seals Y / N / NA**	**Intact: Y / N / NA** **Temperature Received:**	**Condition:**	

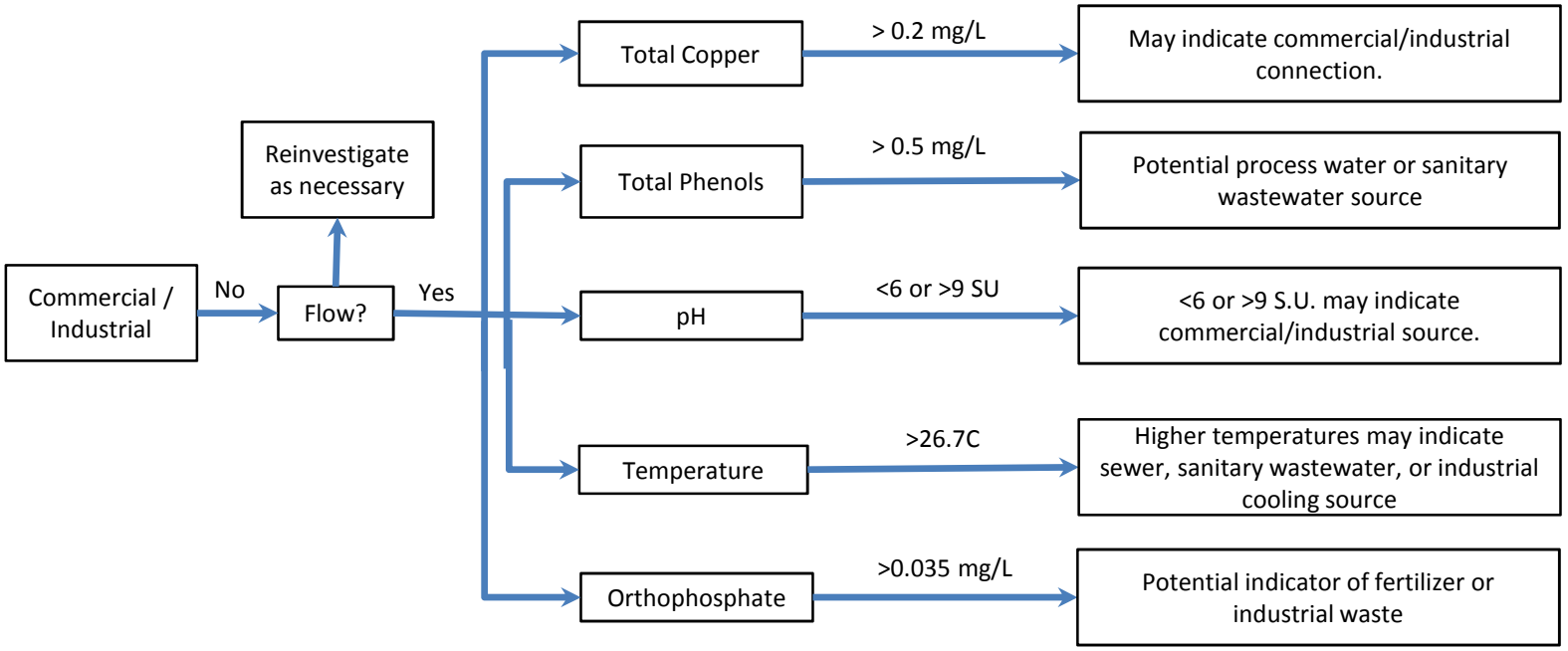
REV. 2/19/10 WHITE: STAYS WITH SAMPLE(S) YELLOW: LAB PINK: SAMPLER

Appendix D: Source Tracing Flow Chart



Source Tracing Flow Chart: Residential

Source Tracing Flow Chart: Commercial / Industrial



Appendix E: Thresholds for Documented Flowing Outfalls

Specific water quality thresholds will be used in conjunction with loading calculations, specific source information, and other program criteria to make the determination whether to discontinue monitoring at any individual previously documented flowing outfall. As defined in the Permit "the sample results must be evaluated to identify feasible actions necessary to eliminate such flows and ensure compliance of Part 1.D of the Permit". If sample analytical results are in exceedance of any of the thresholds listed in Table E-1 for a given outfall, then they must be evaluated to identify feasible actions necessary to eliminate flows. Annual sampling is required until justification exists that the discharge complies with Part 1.D of the permit. If sample analytical results are not in exceedance of any thresholds listed in Table E-1 for a given outfall, then the outfall is considered an allowable discharge and does not require additional sampling or evaluation. Outfalls with allowable discharges and outfalls with no observed flow are to be reinvestigated on a five year rotation.

Table E-1. Thresholds for Water Quality Parameters

Constituent	Threshold	Basis	Source
pH	6.5 - 9.0	Idaho Aquatic Life	IDAPA 58.01.02.250.01.a
Temperature	22 C 19 C	Salmonid Spawning – Peak Salmonid Spawning - Max. daily average	IDAPA 58.01.02.250.02b
Turbidity	Not to exceed 50 NTU greater than background - instantaneous	Idaho Aquatic Life	IDAPA 58.01.02
Dissolved oxygen (DO)	6.0 mg/L	Salmonid Spawning	IDAPA 58.01.02.278.01.02.278.01
Conductivity	>50 and <1500	Typical US River Observations	EPA
Total chlorine	0.019 mg/L CMC 0.011 mg/L CCC	Idaho Aquatic Life	IDAPA 58.01.02
Total copper	1.3 mg/L 1.0 mg/L	National Primary Drinking Water National Secondary Drinking Water	IDAPA 58.01.02
Total phenols	21 mg/L	Idaho Human Health Consumption (Water/Organism)	IDAPA 58.01.02
E. coli	406 CFU/100 mL	Idaho Criterion for Primary Contact Recreation; single sample	IDAPA 58.01.02.251.01.c
Total suspended solids	80 mg/L (14 day)	Idaho Aquatic Life; Lower Boise River TMDL 14-day target	Lower Boise River TMDL (1999)
Total phosphorus	0.07 mg/L	Eutrophication	Boise River TMDL
Dissolved orthophosphate	0.07 mg/L	Guideline threshold – no specific criteria	
Detergents as Surfactants	Presence	Indicative of illicit connection – should not be present in dry weather flows	

ACHD may continue or increase the sampling frequency of an outfall until sufficient data exist to determine that a discharge is allowable under the permit requirements and will no longer require annual sampling.

Appendix 17
Phase I Outfalls Removed from Previous Flows List

Phase I Outfalls Removed from Dry Weather Flows List

#	OF ID	Lat.	Long.	Comments
1	3n1e10_003	43.607989	-116.315947	Intermittant flow due to residential overwatering
2	3n1e11_009	43.615983	-116.29569	Irrigation Ownership
3	3n1e14_012	43.594986	-116.314111	Intermittant flow due to residential overwatering
4	3n1e22_001	43.588699	-116.314528	Historical flow didn't meet antecedent dry period of >72 hours of <0.1" precipitation
5	3n2e05_013	43.621688	-116.244544	Intermittant flow due to residential overwatering
6	3n2e08_018	43.606967	-116.238243	No flow observed during any of three irrigation time periods 2015
7	3n2e09_017	43.612328	-116.227382	Intermittant flow due to residential overwatering
8	3n2e10_020	43.610896	-116.213122	Intermittant flow due to commercial overwatering
9	3n2e14_016	43.601412	-116.190823	No flow observed during any of three irrigation time periods 2015
10	3n2e15_006	43.598695	-116.213462	No flow observed during any of three irrigation time periods 2015
11	3n2e15_016	43.601505	-116.208034	Intermittant flow due to residential overwatering
12	3n2e15_023	43.598676	-116.213466	Intermittant flow due to residential overwatering
13	3n2e18_012	43.599566	-116.256638	Irrigation conveyance - not ACHD ownership
14	3n2e23_008	43.586071	-116.180488	Intermittant flow due to residential overwatering
15	3n2e24_004	43.583144	-116.156937	Intermittant flow due to residential overwatering
16	3n2e24_036	43.579812	-116.171112	Intermittant flow due to residential overwatering
17	3n2e26_017	43.569335	-116.180851	Intermittant flow due to commercial overwatering
18	3n2e36_005	43.546504	-116.153755	No flow observed during any of three irrigation time periods 2015
19	3n3e29_002	43.565114	-116.132816	Historical flow didn't meet antecedent dry period of >72 hours of <0.1" precipitation
20	4n1e34_022	43.635543	-116.316691	Irrigation Ownership
21	4n1e35_006	43.642053	-116.313782	Intermittant flow due to residential overwatering
22	4n1e36_008	43.645234	-116.285314	Intermittant flow due to residential overwatering
23	4n1e36_011	43.644834	-116.281635	Intermittant flow due to residential overwatering
24	4n2e18_001	43.679496	-116.271584	No flow observed during any of three irrigation time periods 2015
25	4n2e19_021	43.664431	-116.258296	Intermittant flow due to residential overwatering
26	4n2e30_011	43.656609	-116.263969	Historical flow didn't meet antecedent dry period of >72 hours of <0.1" precipitation
27	4n2e32_003	43.64187	-116.250985	No flow observed during any of three irrigation time periods 2015
28	4n2e32_008	43.636008	-116.240817	No flow observed during any of three irrigation time periods 2015
29	4n2e32_011	43.639294	-116.240811	No flow observed during any of three irrigation time periods 2015
30	4n2e34_002	43.643581	-116.204911	Intermittant flow due to residential overwatering
31	4n2e34_014	43.641257	-116.208423	License Agreement groundwater pump - Ski rental shop - Bogus Basin Rd.
32	4n2e35_002	43.641233	-116.186699	City of Boise Ownership

#	OF ID	Lat.	Long.	Comments
33	3n1e10_004	43.607587	-116.332032	Outfall Abandoned with reconstruction of Franklin / Cloverdale intersection
34	3n1e14_005	43.593936	-116.310805	Outfall removed
35	3n1e16_003	43.599271	-116.339224	Not a Previous Flow - no historical flow
36	3n1e25_004	43.561465	-116.293934	Unicorporated Boise - Unphased
37	3n2e04_005	43.620162	-116.232909	Not a Previous Flow - no historical flow
38	3n2e14_014	43.603262	-116.193291	Outfall has been abandoned
39	3n2e36_006	43.546407	-116.153787	Previous irrigation infiltration eliminated
40	4n1e28_001	43.655808	-116.334553	No flow observed during any of three irrigation time periods 2015
41	4n1e36_001	43.648312	-116.292258	Not a Previous Flow - no historical flow
42	4n1e36_007	43.645205	-116.285767	No flow observed during any of three irrigation time periods 2015
43	4n2e17_002	43.688179	-116.247692	Not a Previous Flow - no historical flow
44	4n2e30_016	43.650204	-116.268946	Unphased
45	4n2e34_003	43.643386	-116.205159	Not a Previous Flow - no historical flow

Appendix 18
Quality Assurance Program Plan for NPDES Storm Water Permit Monitoring

Quality Assurance Program Plan for NPDES Storm Water Permit Monitoring Boise City and Garden City, Idaho

NPDES Permit No. IDS-02756-1
Ada County Highway District, et al.

October 7, 2014

Prepared by:
Ada County Highway District
Brown and Caldwell

Quality Assurance Program Plan
for NPDES Storm Water Permit Monitoring
Boise City and Garden City, Idaho

NPDES Permit No. IDS-02756-1
Ada County Highway District, Et Al.

October 7, 2014

Prepared by:
Ada County Highway District
Brown and Caldwell

Section 1

Group A: Project Management

Group A elements describe general project management, project objectives and the roles of participants.

1.1 Element A1 Signature Page

Quality Assurance Program Plan (QAPP)

For NPDES Storm Water Permit Monitoring

NPDES Permit No. IDS-02756-1

October 7, 2014

Ada County Highway District

Date: 10/20/14

Erica Anderson-Maguire, ACHD Storm Water Quality Program Manager

Monica Lowe Digitally signed by Monica Lowe DN: cn=Monica Lowe, o, ou, email=mlowe@achdidaho.org, c=US Date: 2014.10.20 11:06:51 -06'00'

Date: _____

Monica Lowe, ACHD Program Coordinator and Quality Assurance Officer

Brown and Caldwell

Date: 10/8/14

Ted Douglass, Project Manager, Brown and Caldwell

Date: 10/8/14

Annika Deutsch, Project Quality Assurance Officer, Brown and Caldwell

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List of Abbreviations

ACHD	Ada County Highway District
BC	Brown and Caldwell
BMP	Best Management Practice
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	Environmental Protection Agency
GI	Green Infrastructure
HAZWOPER	Hazardous Waste Operations and Emergency Response
LID	Low Impact Development
MDL	Method Detection Level
MΩ	Megaohms
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
pdf	Portable Document Format
PMEP	Program Monitoring and Evaluation Plan
PRDL	Project Required Detection Limit
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RO	Reverse Osmosis
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
WQL	Boise City Water Quality Laboratory

1.3 Element A3 – Distribution List

Copy 1 Ada County Highway District Stormwater Section

Copy 2 Robbin Finch, City of Boise

Copy 3 Greg Vitley, Idaho Transportation Department, District 3

Copy 4 Sarah Hansen, Boise State University

Copy 5 Ryan Ambruster, Ada County Drainage District No. 3

Copy 6 Kevin Wallis, Garden City

Copy 7 Brown and Caldwell

Copy 8 Boise City Water Quality Laboratory

All recipients on the distribution list will be issued numbered copies of the Quality Assurance Project Plan (QAPP). Revisions to the QAPP will be made using document control procedures with revised, dated pages to be inserted into the QAPP. When necessary, the QAPP will be reissued in full to all parties on the distribution list.

Minor administrative changes to the QAPP will be addressed by issuing revised pages on an as-needed basis. A record of these changes will be maintained with each QAPP using Table 1.3. Major revisions will be tracked using the next consecutive whole number, and minor changes will be tracked using the next consecutive decimal number. A new QAPP will be reissued whenever major changes are necessary. Since this is a new permit, the revision numbering system will start over. The initial issuance of the QAPP as it pertains to the NPDES Phase I Permit effective February 1, 2013 will begin with V1.0.

Table 1.3 Changes to QAPP Since Last Major Revision

Revision Number	Date	Pages Reissued	Revision Made	Pages Sent to QAPP Recipients (Y/N)	Program Manager Signature
V1.0	2014	All	Full Version Issue	Y	

1.4 Element A4a – Project Organization

This (QAPP) is intended to cover the monitoring requirements of NPDES Permit No. IDS-02756-1 (referred to as Permit, a copy of which is provided in Appendix A). The permittees are: Boise City, Garden City, Ada County Highway District (ACHD), Boise State University, Idaho Transportation Department District 3 and Ada County Drainage District No. 3. The permittees received this permit on December 12, 2012 effective on February 1, 2013.

EPA-Required QAPP elements are addressed as either program elements, or elements of individual monitoring plans. Program elements are described in full in this QAPP document. Program elements consist of the standardized monitoring components that all individual monitoring plans reference. Monitoring plan elements are those components that contain details specific to each individual monitoring plan. Plan organization, responsibilities, and objectives are derived from the Program Monitoring and Evaluation Plan (PMEP), which serves as guidance to standardize stormwater management under this Permit as a whole, including the approach to quality assurance and monitoring plan implementation. A list of program and monitoring plan elements is included in Table 1.4.

Table 1.4 QAPP Element Document Reference

EPA Recommended Quality Assurance Project Plan Elements	Program Element	Individual Plan Element
Group A: Project Management		
A1 – Title and Approval Sheet	X	
A2 – Table of Contents	X	X
A3 – Distribution List	X	
A4a – Project Organization	X	
A4b – Task Organization		X
A5 – Problem Definition/Background	X	X
A6 – Project/Task Description		X
A7a – Quality Objectives and Criteria for Measurement Data	X	
A7b – Method Dependent Criteria for Measurement Data		X
A8 – Special Training Needs/Certification	X	
A9 – Documents and Records	X	X
Group B: Data Generation and Acquisition		
B1 – Sampling Process and Design		X
B2 – Sampling Methods		X
B3 – Sample Handling and Custody		X
B4 – Analytical Methods		X
B5a – Quality Control	X	
B5b – QA/QC Sampling Schedule		X
B6 – Instrument/Equipment Testing, Inspection, and Maintenance		X
B7 – Instrument/Equipment Calibration and Frequency		X
B8 – Inspection/Acceptance of Supplies and Consumables	X	
B9 – Non-direct Measurements	X	
B10 – Data Management	X	X
Group C: Assessment and Oversight		
C1 – Assessments and Response Actions	X	
C2 – Reports to Management	X	
Group D: Data Validation and Usability		
D1 – Data Review, Verification, and Validation	X	
D2 – Verification and Validation Methods	X	

Table 1.4 QAPP Element Document Reference		
EPA Recommended Quality Assurance Project Plan Elements	Program Element	Individual Plan Element
D3 – Reconciliation and User Requirements	X	

1.5 Element A4b – Task Organization

The program monitoring activities are summarized in elements A5 and A6 below and are described in detail in individual monitoring plans for each monitoring task. ACHD is the lead agency for this Permit monitoring and contracts with a consultant responsible for assisting the monitoring process. The Boise City Water Quality Laboratory (WQL) will provide laboratory services. Key roles or job functions for this project are described below and are included in the overall program organization chart in Figure 1. Organization charts specific to each monitoring program are provided in individual monitoring plans.

ACHD Task Organization

- The *Program Manager* has overall responsibility for management of the Permit monitoring programs.
- The *Program Coordinator* is responsible for coordinating and implementing ACHD's stormwater monitoring programs as related to the National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Loads (TMDL) federal regulations;
- The Program Coordinator will also serve as *Program Quality Assurance/Quality Control (QA/QC) Officer* reviewing project data for conformance to the project objectives and ensuring that corrective action is taken, where appropriate. The Program Coordinator may delegate selected responsibilities to the Stormwater Quality Specialist (Monitoring).
- The *Stormwater Quality Specialist (Monitoring)* is responsible for day-to-day project operations for specific monitoring programs. He or she will direct subcontractors, maintain project records including program data, forms, and documents, calibrate and maintain test instruments, and maintain an adequate stock of field supplies.
- *ACHD Field Sampling Staff* will conduct field monitoring activities and field maintenance activities under the direction of the Stormwater Quality Specialist (Monitoring)

Consultant Task Organization

- The *Project Manager* is responsible for all tasks contracted to a consultant. This role will coordinate with other consultant personnel to assure monitoring crews are available when necessary, report results, advise the Program Coordinator as requested, and schedule personnel as appropriate to meet project deadlines.
- The Technical Director is responsible for providing senior technical review of all deliverables to ACHD. The technical director will provide technical guidance throughout the project as necessary.
- The *Field Coordinator* is responsible for conducting monitoring events. This role will oversee and participate in collection of samples, report storm event results, and maintain field-located sampling equipment. The *Field Coordinator* will also serve as the *Site Safety Officer* during monitoring events.
- *Field Staff* will conduct field monitoring activities and field maintenance activities under the direction of the *Field Coordinator*.
- The *Project Quality Assurance Officer* will assist the *Project Manager* with QA/QC issues and advise the *Program QA/QC Officer* to ensure that project data conform with program requirements.

Laboratory Task Organization

- *Laboratory Project Managers* have responsibility for ensuring that sample analyses are performed and reported according to project requirements. They are also responsible for scheduling the availability of laboratory staff, receiving and filling sample container requests, and scheduling sampling events, when applicable.
- *Laboratory Analysts* will conduct laboratory analyses and prepare sampling containers under the direction of their respective *Laboratory Project Manager*.

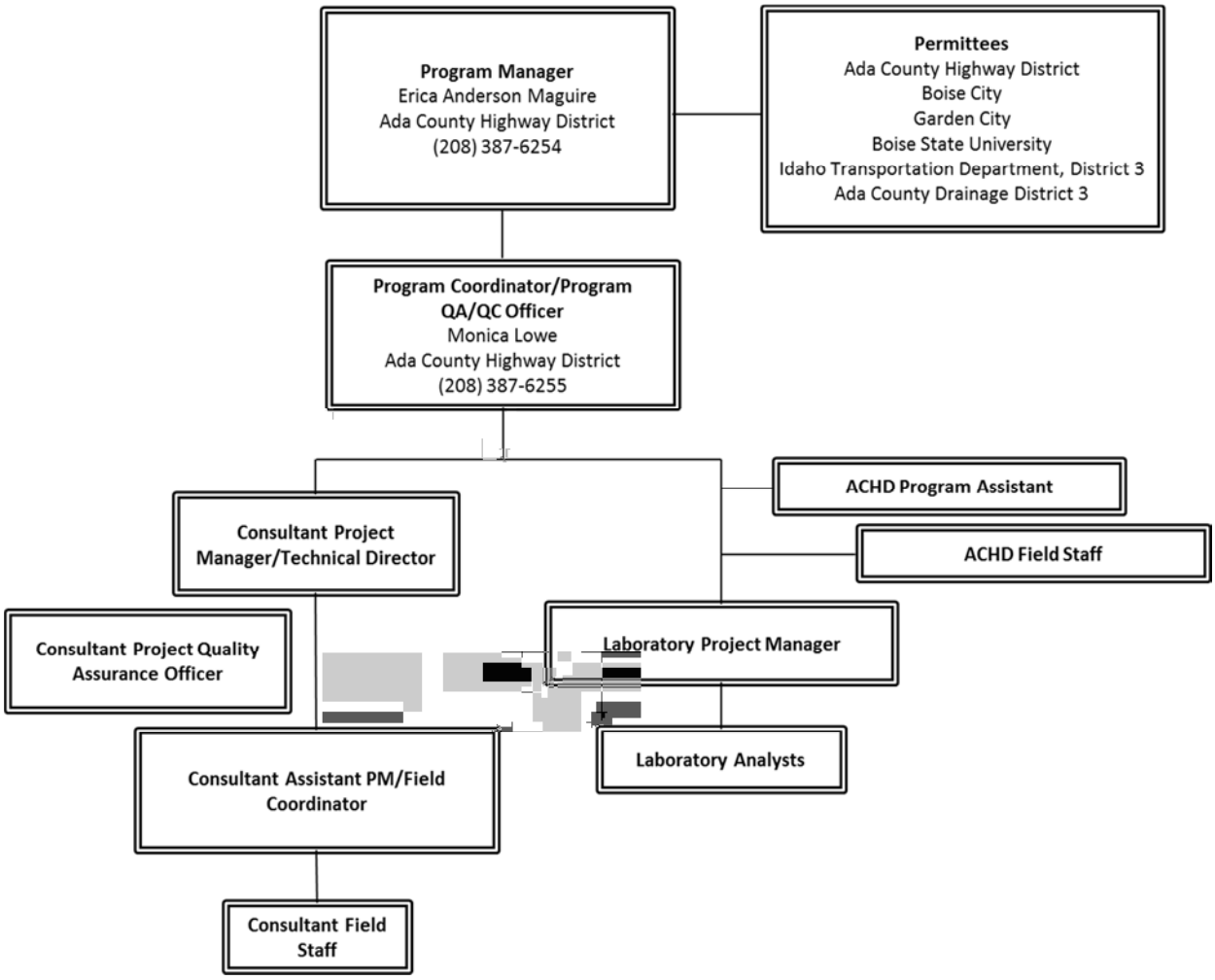

Figure 1-1: Monitoring Organization Chart

1.6 Element A5 – Problem Definition/Background

This QAPP includes all monitoring activities required by the Permit. The Permit authorizes discharges to waters of the United States from municipal separate storm sewer systems (MS4s) owned or operated by the permittees within the corporate boundaries of Boise City and Garden City, Idaho. As described in Part IV of the permit, monitoring includes:

- Storm Water Outfall Monitoring
- In-stream Water Quality Monitoring
- Dry Weather screening for illicit discharges
- Monitoring of permanent structural stormwater management controls (best management practices [BMPs]) and Green Stormwater Infrastructure (GSI) Pilot Projects. BMP and GSI monitoring, though not expressly required under the permit, will be conducted to assist with effectiveness evaluations.

The City of Boise conducts in-stream water quality monitoring to comply with their NPDES wastewater permit and has developed a separate quality assurance plan. This plan is included as Appendix B.

Data gathered to support the Permit will be used in the assessment of pollutant reduction to satisfy the permit general requirements. Data collected through monitoring activities might also be used to estimate stormwater loadings for comparison with Waste Load Allocations and Total Maximum Daily Loads or support watershed and land use management. Data collected by ACHD over the course of the previous permit, along with data from the US Geological Survey or others, may be used for these purposes.

Data collection efforts addressed in the QAPP and in individual monitoring plans are guided by the goals and objectives described in the PMEP. The PMEP also addresses evaluation of monitoring program results and effectiveness and describes procedures for identifying areas for improvement in data collection, management, and quality control efforts. Throughout the duration of the Permit, program evaluations will be used to update the QAPP and individual monitoring plans as part of the iterative process of application of the PMEP.

1.7 Element A6 – Task Description and Schedule

Monitoring and assessment/evaluation task descriptions have been incorporated into the individual monitoring plan for each monitoring program. Monitoring plan descriptions include a summary of the work to be performed as well as monitoring schedules, monitoring site descriptions, and specific tasks associated with data collection efforts.

1.8 Element A7a – Quality Objectives and Criteria for Measurement Data

The data quality objectives (DQOs) for this program have been developed following the processes outlined in Environmental Protection Agency (EPA) guidance document QA/G-4 Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA 2006. This process acts to inform the development and implementation of adequate procedures to ensure the collection of representative data of acceptable and known quality that meets performance criteria for the project.

1.8.1 DQOs

Monitoring efforts will provide data of sufficient quality and quantity in accordance with permit requirements to broadly estimate reductions in annual pollutant loads, evaluate effectiveness of BMPs and GSI projects, and support watershed and land use management initiatives.

Data Quality Indicators (DQI) have been established to set measurable qualitative and quantitative goals for data acceptance that meet the program DQOs described above. Each DQI is described below. DQIs are the basis for addressing field and laboratory analytical instrument performance as well as sample collection and handling procedures.

1.8.1.1 Project-Required Detection Limits and Sensitivity

The sensitivity of the entire sampling and analysis system must be adequate to detect the required constituents at levels comparable to Idaho's in-stream water quality standards, as applicable to the Boise River, the ultimate receiving water. Although the stormwater data are not directly compared to water quality standards, DQOs dictate that project-required detection limits (PRDLs) should be at a similar level so that upstream sources of various constituents to the Boise River can be evaluated if needed. It is not necessary to accurately measure constituent concentrations substantially below in-stream water quality standards. Laboratory Method Detection Limits (MDLs) will generally fall below those standards, and samples are expected to be free of interferences at those levels. For this program, the more conservative MDLs serve as adequate PRDLs. These PRDLs are included in the Data Quality Indicators Table in each individual monitoring plan.

1.8.1.2 Accuracy

The accuracy of the data is a measure of the extent to which a measured value represents the true value. Analytical accuracy is assessed by analyzing spiked samples with known standards and measuring the percent recovery. Laboratory accuracy is measured against quantitative matrix spike and surrogate spike recovery and is deemed acceptable if it is within an established range. Accuracy testing results will be used by the laboratory to assess analytical instrument performance.

1.8.1.3 Precision

Precision is a measurement of the reproducibility of the analytical data. Precision will be evaluated using field duplicate and laboratory duplicate samples. Precision criteria are included in the Data Quality Indicators Table in each individual monitoring plan. Poor sample performance in precision testing may be indicative of problems with sample homogeneity, matrix interferences, poor sample handling, contamination, or inadequate sensitivity of analytical methods. Precision testing results will be used to guide sample collection, handling, and analysis efforts in the event that deficiencies are reported for sample performance.

1.8.1.4 Bias

Another DQO is to minimize sample bias. Bias is typically a systematic error that results in a tendency to produce or report data in one direction. In this program, bias is controlled by using standard data collection, sample preservation, sample transport, and sample storage procedures to reduce most sources of sample bias. The laboratory uses standard quality control procedures applicable to each specific analytical method. These procedures include analysis of method blanks, matrix spikes and duplicates, surrogate analyses, and check standards analysis. Reported values that are qualified as having the potential for bias, will be considered estimated and use will be limited.

1.8.1.5 Representativeness

The representativeness is a measure of the degree to which data accurately and precisely indicate environmental conditions. For the monitoring programs covered under this QAPP, the selected analytical parameters have been identified as constituents of interest or concern based on typical constituents that have been previously observed in stormwater and urban runoff. The data will be considered to be representative if they meet precision limits.

Representativeness is also maintained by designing sample collection procedures to collect samples that represent actual discharge conditions. Manufacturers' specifications and site configuration are also considered when using, maintaining, and installing/deploying monitoring equipment to ensure data provide an accurate representation of site conditions. Other factors that affect representativeness for specific monitoring programs are addressed in each individual monitoring plan.

1.8.1.6 Comparability

The comparability of a data set is the extent to which the data set can be compared to others. For this program, comparability is established through the use of standard analytical methodologies and reporting formats. The data sets generated through this program will be used to evaluate trends over time, meet the requirements of the Permit, estimate pollutant concentrations and loadings, evaluate structural controls and GSIs, and support watershed and land use management initiatives.

1.8.1.7 Completeness

Completeness is a comparison between the amount of usable data collected versus the total amount of data collected. Completeness is measured as the percentage of total samples collected and analyzed overall for individual parameters and for individual sites that are not rejected, compared to the number of samples collected. All data will undergo a data review and validation process that includes reviewing data for holding times, evaluating data with respect to laboratory qualified samples, and evaluating data with respect to field QA/QC samples. Grab sample data, field parameter data, and rainfall data are generally more susceptible to problems and interference affecting completeness. Completeness of flow data and laboratory analytical data are typically high.

Diligent sample handling and preservation procedures and timely sample processing help to maximize completeness. Usable data comparisons will be conducted with each annual report to determine completeness percentages for each monitoring year. An overall program goal of 95 percent has been established for completeness.

1.8.1.8 Sufficiency

Data objectives for sufficiency are based on the amount of useable data required to perform the level or type of analysis necessary for each monitoring element. The project data set will be considered meeting the DQOs for sufficiency when enough useable data have been collected to meet the requirements of the Permit. The goal for sufficiency is 100 percent. Each data set will be evaluated individually as the data are reported, and adjustments will be made to subsequent sampling events as needed to ensure that the provisions of the permit are adequately addressed.

1.9 Element A7b – Method Dependent Criteria for Measurement Data

DQIs specific to analytical methods include project-required detection limits and precision limits, which are summarized in the Data Quality Indicators Table located in the QA/QC Section of each individual monitoring plan.

1.10 Element A8 – Special Training Requirements/Certification

All field personnel must be familiar with general environmental sampling procedures and confined space "awareness" and must read the Standard Operating Procedures (SOPs) manual for the monitoring program(s) in which they participate. In addition, all field personnel must sign the Field Work Safety Plan (FWSP) for the monitoring program(s) in which they participate. All field personnel will attend a safety briefing before sampling and sign a safety briefing acknowledgement form. The Program Coordinator will maintain ACHD's records.

All consultant personnel working in areas where hazardous chemicals or fumes have an increased potential to occur will have received Hazardous Waste Operations and Emergency Response (HAZWOPER) training. In addition, they will have attended confined space "awareness" training and an annual safety review distinctive to this project. Routine monitoring activities are not expected to encounter conditions necessitating HAZWOPER training. Personnel assigned to maintenance tasks that require bodily entry into a manhole will also have completed a course in Confined Space Entry. Training records for consultant personnel will be maintained by the consultant's Health and Safety Officer.

General health and safety and SOP training will be conducted annually for each monitoring program. This will allow the monitoring teams to identify health and safety issues that need to be addressed and ensure compliance with program SOPs.

1.11 Element A9 – Documentation and records retention

All program-related records will be maintained as described in Permit Part IV (B). Project documentation will include:

- This QAPP
- PMEP
- Storm Water Management Plan
- Storm Water Outfall Monitoring Plan
- Boise City In-stream Water Quality Monitoring Plan;
- Boise City QAPP for In-stream Water Quality Monitoring
- GSI Monitoring Plan
- Field Work Safety Plan for Stormwater Sampling
- Task guidance documents and Standard Operating Procedures
- Annual Reports
- Sampling Event Reports
- Event readiness forms
- Weather forecasts and precipitation records
- Sampling Event Communication Forms
- Field notes (generally recorded on preprinted forms)
- Maintenance forms
- Instrument calibration and maintenance records
- DataSight
- Database Guidance Document
- Chains-of-custody

- Laboratory reports
- Dry Weather Outfall Screening Plan

Project documents will be stored on the secured ACHD network in the file system or on in the DataSight data management system. DataSight includes a feature called control documents, which allows users to upload documents into the database and attach the documents to a specific program. The database also features an audit log to track document uploads for quality and version control. The following provides an overview of the process and responsibilities for maintenance of documents and records.

Project Planning Documents

The Program Coordinator will ensure that project plans (QAPP, PMEP, Storm Water Management Plan, Monitoring Plans, FWSPs, and SOPs) are revised as needed. The revision date will be printed in the footer on each page of these documents. Copies of the plan documents will be distributed to the consultant Project Manager and Field Coordinator, laboratory personnel, and permittees as needed. Electronic copies of the plans will be stored on the ACHD network.

Climatological Data

Weather information and forecasts will typically be obtained from the National Weather Service (NWS) Boise airport station website at http://www.crh.noaa.gov/forecasts/IDZ014.php?warncounty=IDC001&city=Boise+City and http://www.wrh.noaa.gov/climate/index.php?wfo=boi. NWS weather information will be stored electronically. Forecasts will also be summarized in electronic files. Electronic files downloaded from flowmeters, automatic samplers, data loggers, and any other monitoring equipment will be stored on the ACHD network, by water year.

Documentation in the Field

Field notes, maintenance records, and instrument calibration results will normally be recorded on preprinted forms. Each page will be dated and initialed. At a minimum, field notes will include the name(s) of the person(s) conducting the subject activities, sample numbers and locations, maps and diagrams (where appropriate), equipment used, local weather conditions, and any observations deemed unusual by field personnel. Chain-of-custody records will document transmission of the samples from field to laboratory. They will also indicate the analyses requested, including specification of batch quality assurance (QA) samples. If changes to the request are made, they will be documented in writing. The Program Coordinator will be the custodian of paper and electronic records. Data, forms, and records will be transmitted to the consultant Program Manager as needed.

Laboratory Analytical Reports

Laboratory reports will consist of analytical results for all field samples and tables summarizing laboratory QA results. Where available, laboratory reports will include electronic data deliverable files of analytical results and portable document format (pdf) files. Where only paper laboratory reports are delivered, the paper report may be scanned to generate pdf files. Electronic files will be stored on the ACHD network, by water year, laboratory, and then program area. Electronic laboratory report pdf files will be named according to the format LABYYMMDD.pdf, where LAB is a three-letter abbreviation for the laboratory, YY is the two-digit year, MM is the two-digit month, and DD is the two-digit day. Electronic data deliverable files will be named according to the format LABYYMMDD.txt, where LAB, YY, MM, and DD are the same as described above. Paper and electronic copies of laboratory reports be transmitted to the consultant Program Manager as needed.

Documentation of Deviations

In the event that general field practices or other standard procedures deviated from normal procedures, documentation will be made on field forms, in reports, or in field notebooks. These documentations will also include the methods used or suggested to resolve noncompliance. The Program Coordinator will maintain these records.

Section 2
Group B: Measurement/Data Acquisition

Elements in Group B cover aspects of the measurement system design and implementation. Group B elements B1 through B4 are addressed and included in each individual monitoring plan. These elements are listed as follows:

- Element B1 – Sampling Process Design
- Element B2 – Sampling Methods
- Element B3 – Sample Handling and Custody
- Element B4 – Analytical Methods

2.1 Element B5a – Quality Control Requirements

2.1.1 QC Validation

Field QA/QC samples include field blanks, field duplicate samples, laboratory duplicate samples, equipment blanks and rinsate blanks. QA/QC sample definitions and procedure descriptions are listed below.

A field blank is a sample prepared in the field using type I reagent grade water and the appropriate preservatives, if applicable. It is transported in the same cooler as the field samples and serves as a check on the cleanliness of field conditions at the time of sampling. Field blanks are collected alongside grab samples. The blank sample is typically prepared immediately following collection of the parent sample.

A field duplicate is a second aliquot of sample collected at the same time and in the same manner as the first aliquot. Duplicate pairs provide information about the repeatability of sampling and analysis. Field duplicates are collected alongside grab samples.

A rinsate blank is prepared by rinsing the decontaminated sampling equipment with type I reagent grade water and collecting a portion of the rinsate into sample bottles with any applicable preservatives. This type of sample serves as a check on equipment decontamination procedures. Collection of rinsate blanks typically occurs after sample collection and decontamination of the sampling equipment, except for when sampling is planned to coincide with maintenance events as in the case of composite samples.

An equipment blank is prepared by running type I reagent grade water through new sampling equipment and collecting the water into sample bottles with any applicable preservatives. This type of sample serves as a check for the presence of contaminants on new and unused equipment. Equipment blank samples are collected when new sampling equipment is ready for use, but has not yet been in contact with a program sample.

A laboratory duplicate is a duplicate split by the laboratory. This type of sample serves as a check on the lab's ability to representatively split a composite sample and is a test of analytical precision.

Project specific QA/QC procedures are outlined in the appropriate monitoring plan.

2.1.2 Field, Equipment, and Rinsate Blanks

When one of the analytical parameters is detected in a blank, all analytical results associated with that blank batch, exhibiting a concentration of less than five times the concentration detected in the blank, will be qualified. The qualification will indicate the analytical results may be biased high for the samples collected. All concentrations above five times the blank value will be considered valid because any blank contamination is well below the sample concentration.

Blanks will be prepared using type I reagent water generated by the WQL. This water is obtained from a private well and treated by reverse osmosis (RO), ion exchange, and ultraviolet disinfection. Their minimum criterion for acceptability is 18.3 megaohms (MΩ), referred to as type I reagent grade. The use of the type I reagent grade water in blanks is to ensure that the equipment is not picking up constituents of concern from the use of retail-grade distilled water.

2.1.3 Duplicate

Field duplicate pairs provide information about the repeatability of sampling and analysis. For all samples (excluding bacterial analyses) where laboratory analyses indicate a sample concentration of less than five times the MDL, the difference between the concentrations of the field duplicates will be considered acceptable if it is within an amount equal to the MDL. For all samples with concentrations greater than five times the MDL, the relative percent differences (RPDs) for each analyte will be considered acceptable if they are within 20 percent for water matrix samples and 35 percent for solids samples.

Relative Percent Difference Equation

$$RPD = \frac{|x_1 - x_2|}{((x_1 + x_2)/2)} \times 100\%$$

Where:

RPD = Relative Percent Difference

x_1 = Duplicate

x_2 = Parent

The inherent variability associated with bacteria analyses from grab samples requires a different set of criteria to verify sample collection results. To qualify and identify outliers for this analyte, the logarithmic RPD_{log} will be calculated by the Program Coordinator. The variability associated with extremely low numbers indicates little to no association between most probable number (MPN) with a concentration of less than 10 MPN/100 mL. All sample pairs that are both less than 10 MPN/100mL will be automatically included in the database without qualifier flags. For values where the parent and the duplicate concentrations are greater than 100 MPN/100mL, the RPD_{log} will be calculated and will be considered acceptable if calculated RPD is 40 percent or less. In the event the RPD is higher the data will still be used because of the variable nature of E. coli. However, the samples should be flagged and qualified as not meeting quality control requirements.

Logarithmic Relative Percent Difference Equation

$$RPD_{\log} = \frac{\left|\log(x_1) - \log(x_2)\right|}{\left(\left(\log(x_1) + \log(x_2)\right)/2\right)} \times 100\%$$

Where:

RPD_{log} = Relative Percent Difference of Log Values

x_1 = Duplicate

x_2 = Parent

2.1.4 QC Management

In the event that insufficient volume is available in a single QC sample for all of the scheduled QC analyses, additional QC samples may be collected and submitted for analysis.

The laboratory will perform additional internal QA/QC determinations as documented in their QAPP document included in Appendix D.

The normal laboratory data package will include analytical results for field samples and field QA samples and sample comments. Limited QA data will also be included, as appropriate. However, raw data, laboratory notebook pages, and similar supporting data will be maintained at the laboratory and available at ACHD's request. A more detailed reporting package will be requested and reviewed in the event of a change in laboratories, a major change in methods, or to troubleshoot potential data problems.

2.1.4.1 Sample Naming Conventions for the Chains-of-Custody

Quality control (QC) samples for a given sampling event will be given names that are similar but not identical to the other analytical samples so that QC samples cannot be easily distinguished by the laboratory, to ensure that all samples are handled and analyzed in the same manner. Additionally, sample collection times for QC samples will be recorded on the Chain of Custody as 12:00. Actual QC sample collection times will be recorded on the field form.

The QC samples will be given a number associated with the term QC. This number will start with 1 and count up to the total number of QC samples taken during an event for the specific monitoring program. In addition a moniker or abbreviation of the program will be part of the QC sample name. For example, if two QC samples are collected during a storm event for the Phase I stormwater monitoring program the two samples will be named P1QC-1 and P1QC-2.

Equipment blanks and rinsate blanks are not associated with a particular sampling event and will not be submitted as laboratory blind samples. These samples will be named for the monitoring station followed by the two letter abbreviation appropriate to the QC sample type (Whitewater-EB and Whitewater-RB, for example).

2.2 Element B5b – QA/QC Sampling Schedule

Random number generation will be used to develop a QA/QC sample schedule for each individual water year. The schedule will be used to establish the targeted QC site for each event, as well as an alternate QC site with the goal of collecting one set of QC samples for each event. Each site is assigned a number and a random number generator equation is run for each event. In the event that

the selected site cannot be sampled for any given event, the predetermined alternate site will be used. The alternate site selection process will be reproduced to provide additional levels of alternate sites for each event as needed. Detailed QA/QC sample collection schedules will be identified in each individual monitoring plan.

ACHD may choose to conduct additional QA/QC to address data discrepancies, potential sample contamination, or other QA/QC issues. These events will be handled on an as-needed basis, depending on the particular issue(s) involved.

2.3 Element B6 – Instrument/Equipment Testing, Inspection and Maintenance Requirements

Field instruments will be visually inspected and tested before use to ensure that they are in good working order. Maintenance and cleaning will be performed in accordance with manufacturers' instructions. Each individual monitoring plan includes a list of the specific instruments used in the monitoring program. ACHD will conduct the testing, inspection, and maintenance and will keep a log of all maintenance at the ACHD Shed.

2.4 Element B7 – Instrument Calibration and Frequency

Instrument calibration procedures and frequencies are outlined in the manufacturer's equipment manuals for each instrument. Procedures in the guidance manual are based on manufacturer specifications and ACHD experience. Calibration frequency may be conducted more frequently as warranted by equipment performance. Calibration records will be part of the project documentation maintained by the Program Coordinator.

2.5 Element B8 – Inspection/Acceptance Requirements for Supplies and Consumables

Plastic bags and grocery store deionized water will be food grade (i.e., purchased from a grocery store). Supplies will be visually inspected for evidence of cleanliness, and any items showing visible contamination or damage will be discarded unused.

RO water will be prepared and bottled by WQL in a clean carboy in the amount requested by ACHD for each project need. In order to maintain sample integrity, ACHD will not retain unused RO water for future use. Carboys obtained from the lab will be visually inspected for evidence of cleanliness, and any items showing visible contamination or damage will be discarded unused.

Sample containers will be provided to ACHD by the analytical laboratory(ies) prior to each event. Upon receipt, all sample containers will be visually inspected by the Program Coordinator or designee and returned if they appear to be contaminated or otherwise compromised.

Nitrile gloves and other disposable sampling equipment will be inspected for contamination upon receipt.

2.6 Element B9 – Data Acquisition Requirements (Non-Direct Measurements)

Additional information from third parties may be obtained to support the monitoring program objectives. All data from outside sources will be reviewed against the acceptance criteria prior to use. An example of an outside data source typically utilized by the program is the meteorological data

obtained from the NWS. Each monitoring plan will include the identification of potential outside sources to be used in the program. Non-Direct Measurement data will be identified and described in each monitoring plan that relies on this data.

2.7 Element B10 – Data Management

As described in element A4, the *Project Coordinator* will store original field data sheets, chains-of-custody, and laboratory reports in binders at ACHD headquarters. Field form pdfs, electronic laboratory data and chains-of-custody, sampling event communication forms, daily weather forecasts, and electronic data downloaded from field equipment are stored electronically on the ACHD network.

ACHD has acquired DataSight database software for managing data collected from stormwater monitoring programs. The intent of using this program is to provide ACHD a safe and secure platform for storing, validating, viewing, analyzing, and retrieving data. ACHD will utilize the database to assist with implementation of this QAPP, the PMEP, and the individual monitoring plans.

Additional software programs specific to monitoring equipment will be used to download and interface with flowmeters and rain gauges. Rainfall, flow, depth, and velocity data and sample history will be processed using the American Sigma/Hach *Insight* software. At some rain gauges, rainfall measurements recorded on Hobo data loggers will be processed using the BoxCar software. Data exports from these programs will typically be exported to Microsoft® Excel prior to import into the database. ArcGIS will be used for mapping applications. The dry weather outfall screening program will utilize Microsoft® Access for outfall records; Access data may be migrated into DataSight at a later date.

The DataSight database is configured in four tiers or “levels” under which data is stored and related. The database structure and level dependencies for the stormwater outfall monitoring program are illustrated in Figure 2-1 below.

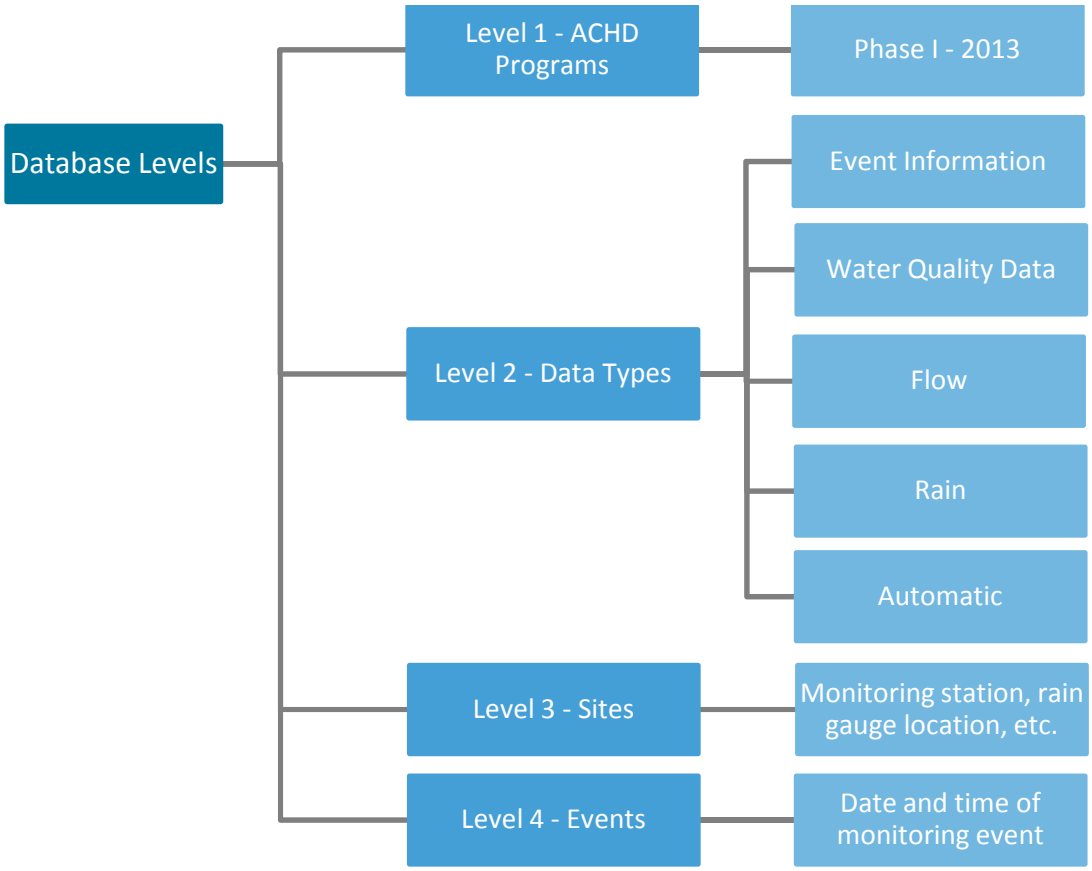

Figure 2-1: Database Levels Setup

Level 1 refers to the specific program to which all subsequent data is related. For this QAPP Level 1 is the Phase I 2013 permit.

Level 2 is categorized by the types of data stored in the database. Data Types can be broken out as follows:

- Event information includes observations noted during sampling, trigger volumes, velocity cutoffs, and event totals for rain and flow
- Water quality includes laboratory results, units of measure, type of sample (e.g., grab or flow-weighted composite), laboratory method, detection limits, laboratory qualifiers, validation qualifiers, and field parameter measurements.
- Flow data includes readings for level, velocity, and flow collected using flowmeters or derived from stream gauges, bucket testing, or qualitative estimates.
- Rain data includes rainfall measurements from rain gauges maintained by ACHD or NWS.
- Automatic data refers to the date and time variables, which must accompany any entry.

Level 3 represents individual sites and is tied to geographical information for each location name. Information stored with each site includes: geographic location, drainage area, land use classification, land use distribution, conveyance system (e.g., piped or open channel), and receiving water.

Level 4 is the date and time of an event. Each event consists of data relating to the variables measured. A time and date stamp is associated with each measurement making that measurement unique within the database.

After the database was installed and setup BC prepared a guidance document (BC, 2014) to provide an overview of the organization of the database. This guidance document further describes data and program relationships as well as the approach ACHD will take to utilize the various functions and capabilities available within the DataSight software. Specific features discussed in the guidance document include the following:

- Organization of data within the levels of the database
- Organization and grouping of variables into data types
- Conversions and calculations ACHD will carry out in the database
- Approach to tying information to individual sites and specific events
- Approach to storing program documents and other important records
- Data import functions to be utilized
- Data analysis, reporting, and export functions that will be utilized for retrieving data for subsequent use
- Quality Assurance/Quality Control (QA/QC) measures and validation
- Data security including information about the ACHD secure servers, access restrictions, and automatic audit logs

Section 3
Group C: Assessment/Oversight

Group C elements address the activities for assuring that the project is being implemented as designed and in accordance with the Permit.

3.1 Element C1 – Assessments and Response Actions

3.1.1 Event and Data Completeness

The Program Coordinator will review the analytical data from each sampling event against the DQIs listed in Section 1.8, within two weeks of receiving the lab analytical results. This review will include the following activities:

- Review field data sheets for completeness and for circumstances which might adversely affect data quality (such as apparently erroneous field measurements or unclear writing).
- Confirm that all samples, including QA/QC samples, were collected as specified.
- Confirm that all samples were delivered to the laboratory promptly.
- Confirm that the appropriate analyses were performed on all samples.
- Confirm that analytical reports on all samples were received.
- Confirm that all qualified data have been correctly identified.

The analytical data, along with QA/QC data from each sampling event, will be entered into DataSight and used in the generation of annual reports. Appendix C contains the Monitoring Program QA/QC Checklist that will be filled out and signed by the Program Coordinator to ensure the completeness of this process. Any deviations from the monitoring plan or issues associated with data from any particular event will be documented in the event report described in section 3.2.

Based on the review of analytical data from each sampling event, changes to subsequent sampling events may be made to ensure that at the end of the year, sufficient data will be available to meet DQOs and permit conditions. This may include additional sampling events for one or more parameters, additional QA/QC samples to investigate data issues or other changes.

At the end of each sampling season, the ACHD Program Manager, ACHD Program Coordinator and consultant Project Manager will meet and discuss the sampling completed during the water year, any problems that were encountered, and any changes that are needed prior to the next sampling year. Changes to the QAPP will be made as needed at that time.

Additional QA/QC checks may be instituted from time to time to assess procedures or investigate apparent problems. These checks will generally be undertaken if data generated by the sampling program is significantly different from data previously generated, or QA/QC data indicate potential problems with one or more analytical parameters.

3.2 Element C2 – Reports to Management

Sampling event reports prepared by the consultant Field Coordinator will be transmitted to the Program Coordinator after each event. These will be stored in folders, separated by event date, at

ACHD headquarters. The NPDES annual reports to the EPA will incorporate all monitoring data for the water year as defined in the permit.

Section 4

Group D: Data Validation and Usability

The elements in Group D, performed after data collection is complete, ensure that the data conform to the specified criteria in the Permit and produce valid, defensible data that aligns with the DQOs.

4.1 Element D1 – Data Review, Validation, and Verification Requirements

Analytical data must meet the laboratories' ordinary internal QA/QC requirements, as described in their respective QA plans. The Program Coordinator will examine the field forms and laboratory reports to verify that all data are complete, sample holding times were met, all samples were analyzed for desired parameters, and detection limits are appropriate (allowing for dilution or matrix interference, as necessary) to meet Permit limitations. The Program Coordinator will also confirm that the laboratory QA samples meet the laboratory's stated control limits and samples are qualified where necessary. Deficiencies will be referred to the laboratory for the corrective actions specified in their QA plan (such as reanalysis). The laboratories update their control limits on a regular basis by adding the results of recent Laboratory Control Standards to a statistical analysis.

Analytical data associated with field QA/QC samples (field blanks, rinsate blanks, and duplicates) will be validated using the methods and criteria described in Section 2.1, and will be qualified where necessary.

Rejection of data in any form will always be based upon professional judgment with consideration given to all aspects of collection, analysis, and management of the specific data point or set in question. Criteria for considering rejection of data includes, but will not be limited to:

- broken chain of custody
- high cooler temperature upon laboratory receipt of samples
- improper chemical preservation of samples
- excessive holding time exceedances

Special handling considerations are included in the monitoring plans to identify the selected approach to specific constituents or situations where it is not feasible to fully execute the procedures required by the EPA approved analytical methods. Special handling considerations will typically address the approach ACHD will take when holding times, filtration requirements, and other method requirements are not expected to be met due to the logistical limitations of a specific monitoring program.

4.2 Element D2 – Validation and Verification Methods

After receipt of laboratory analytical reports the ACHD Program Coordinator will fill out and sign the Monitoring Program QA/QC Checklist that includes a validation review of the elements listed below; this form is included in Appendix C. This documentation indicates that the validation process was done properly and should include any notes pertinent to the use of the data in the annual reports.

Because all QC samples are submitted to the lab with a time of 12:00, it is ACHD's responsibility to review laboratory reports and actual sample collection times to evaluate holding time qualifications for QC samples. It is understood that the lab is required to qualify data according to the information provided by ACHD, and laboratory analytical reports will report any holding time qualifiers as measured from the 12:00 time on the COC.

4.2.1 Validation and verification procedures

Data validation and verification will be performed by the Program Coordinator. Procedures will include, at a minimum, the following actions:

- Review field data sheets for completeness and accuracy and address inconsistencies or need for clarification with sampling team member(s) or validation of instrument performance
- Check that sample collection was conducted in accordance with standard operation procedures
- Check that all analytical reports have been received from the lab
- Review chain-of-custody forms and laboratory reports to confirm that all samples were extracted and analyzed for the desired constituents by the correct methods within the appropriate holding time. Holding time considerations for QC samples are discussed in the paragraph following this list.
- Confirm that results of all method blanks, laboratory duplicates, laboratory control samples, and spikes fall within the limits set by the laboratories.
- Consult with the laboratory and possible raw data review in the event of outliers or unexpected values.
- Confirm that appropriate analytical methods were used.
- Ensure that all data flagged by the laboratory is properly entered into DataSight along with all appropriate flags and data qualifiers.
- Review all data together with field QA/QC samples and assign data qualifiers where necessary.
- Consult with the consultant Project QA Officer or Project Manager to determine if samples that are qualified by the laboratory should be submitted in the annual report and what qualifiers should be added to help define the data.
- Confirm that all DQOs were achieved.

4.2.2 Flagging and Qualifiers in DataSight

Flags and qualifiers will be assigned to data to denote specific quality or usability considerations for the user of the data as part of the data validation and verification process. All data is reviewed and validated after import into the database. Any data stored in the database has the potential to be qualified or flagged. Specific qualifiers will be retained with the raw data import files. The raw data import files will be saved as an attachment in the audit log for each monitoring program.

Flagging will be used to track data that has been qualified as well as to assist users with data organization and review. The following list outlines the flagging structure to be used for the database.

- **Qualified – estimated (yellow flag, Index No. 1)**. Data is qualified but still usable with the understanding that it is an estimate. This type of data is associated with the J qualifier as it pertains to water quality data. The yellow flag may apply to any variable under the Level 2 data types that is qualified and is still useful for calculations and reporting.
- **Qualified – estimated under MDL (orange flag, Index No. 2)**. Data is qualified but still usable with the understanding that it is an estimate (associated with the UJ qualifier). This will apply only to analytical data that is reported below the MDL and is still useful for calculations and reporting.

- **Rejected – data is not usable (red flag, Index No. 3)**. This will apply to data rejected due to sufficiently high concerns for quality and representativeness of the data based on the data quality objectives described in the QAPP (associated with the R qualifier). This data is included for recordkeeping and reporting purposes only and is not useful for analysis or calculations in any capacity.
- **Reported/not used (gray flag, Index No. 4).** Extraneous data not used in calculations. This flag applies to data that has been collected but will be passed by in favor of more representative data if it is available. This data may be used if better data is not available. Typically, data under this flag may have already been qualified for limited usability or quality.
- **Unreviewed (purple flag, Index No. 5).** All data will be reviewed after it has been entered/imported. When data is manually entered it will be flagged during the MDE process. Data imported electronically will be automatically flagged using an application flag during import. After data has been reviewed and the data import/entry was found to be successful (i.e., data is correct and usable as is) the purple flag will be removed.
- **Needs further review (blue flag, Index No. 6).** During review, data may be identified as needing a more in-depth review or other action before it can be accepted in the database without qualification. In these instances, the purple flag will be replaced with a blue flag until the additional review has been completed.
- **QC sample data (green flag, Index No. 7).** QC sample data such as results reported for field duplicates, equipment blanks, and others will be assigned this flag to distinguish these results from parent sample results.
- **Conversion (brown flag, Index No. 8).** Data for which the units have been changed resulting in orders of magnitude being shifted within the same measurement type using the conversion tools in DataSight. These conversions will be assigned an application flag during the conversion process.
- **Calculation output (turquoise flag, Index No. 9).** Data that has been generated using formulas other than conversion and resulting in a different measurement type (e.g., pollutant loading or statistics) will be assigned an application flag during the conversion process.
- **Velocity cutoff zero (pink flag, Index No. 10).** When background flow is present at a monitoring site during setup for a sampling event a velocity cutoff may be programmed into the flowmeter so as not to total flow prior to the start of stormwater runoff sample collection. In these instances the background flow is recorded as zero until the velocity of the flow reaches the cutoff. The pink flag will be assigned to the zeroed out flow data resulting from a velocity cutoff.

In the event that a data entry has more than one applicable flag/qualifier the data will be flagged with the most pertinent flag and a note regarding the other qualifiers will be added to the comments box in the level 4 properties menu for the event. More information regarding data flags and their function in the database is available through the ACHD Database Guidance Document (BC, 2014) and the DataSight Users Manual (Seveno, 2013).

4.3 Element D3 – Reconciliation with DQOs

The activities specified in the Data Completeness and Validation portion of each event report will be used to assess the degree to which the DQOs have been met. This information will be summarized in the annual report. The Program Coordinator will initiate appropriate corrective action in the event that DQOs have not been met.

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Appendix A: NPDES Permit No. IDS-02756-1

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

Authorization to Discharge Under the
National Pollutant Discharge Elimination System

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 *et seq.*, as amended by the Water Quality Act of 1987, P.L. 100-4, the "Act",

Ada County Highway District,
Boise State University,
City of Boise,
City of Garden City.
Drainage District #3,
and the Idaho Transportation Department District #3,

(hereinafter "the Permittees")

are authorized to discharge from all municipal separate storm sewer system (MS4) outfalls existing as of the effective date of this Permit to waters of the United States, including the Boise River and its tributaries, in accordance with the conditions set forth herein.

This Permit will become effective February 1, 2013.

This Permit, and the authorization to discharge, expires at midnight, January 30, 2018.

Permittees must reapply for permit reissuance on or before August 3, 2017, 180 days before the expiration of this Permit, if the Permittees intend to continue operations and discharges from the MS4s beyond the term of this Permit.

Signed this 12th day of December, 2012.

Daniel D. Opalski, Director
Office of Water and Watersheds, Region 10
U.S. Environmental Protection Agency

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I. Applicability

A. Permit Area. This Permit covers all areas within the corporate boundary of the City of Boise and Garden City, Idaho, which are served by the municipal separate storm sewer systems (MS4s) owned or operated by the Ada County Highway District, Boise State University, City of Boise, City of Garden City, Drainage District #3, and/or the Idaho Transportation Department District #3 (the Permittees).

B. Discharges Authorized Under This Permit. Subject to the conditions set forth herein, the Permittees are authorized to discharge storm water to waters of the United States from the MS4s identified in Part I.A.

As provided in Part I.D, this Permit also authorizes the discharge of flows from the MS4s which are categorized as allowable non-storm water discharge, storm water discharge associated with industrial activity, and storm water discharge associated with construction activity.

C. Permittees' Responsibilities

1. **Individual Responsibility**. Each Permittee is individually responsible for Permit compliance related only to portions of the MS4 owned or operated solely by that Permittee, or where this Permit requires a specific Permittee to take an action.
2. **Joint Responsibility.** Each Permittee is jointly responsible for Permit compliance:
   a) related to portions of the MS4 where operational or storm water management program (SWMP) implementation authority has been transferred to all of the Permittees in accordance with an intergovernmental agreement or agreement between the Permittees;
   b) related to portions of the MS4 where Permittees jointly own or operate a portion of the MS4;
   c) related to the submission of reports or other documents required by Parts II and IV of this Permit; and
   d) Where this Permit requires the Permittees to take an action and a specific Permittee is not named.
3. **Intergovernmental Agreement.** The Permittees must maintain an intergovernmental agreement describing each organization's respective roles and responsibilities related to this Permit. Any previously signed agreement may be updated, as necessary, to comply with this requirement. An updated intergovernmental agreement must be completed no later than July 1, 2013. A copy of the updated intergovernmental agreement must be submitted to the Environmental Protection Agency (EPA) with the 1st Year Annual Report.

D. Limitations on Permit Coverage

1. **Non-Storm Water Discharges**. Permittees are not authorized to discharge non-storm water from the MS4, except where such discharges satisfy one of the following three conditions:

   a) The non-storm water discharges are in compliance with a separate NPDES permit;

   b) The non-storm water discharges result from a spill and:

      (i) are the result of an unusual and severe weather event where reasonable and prudent measures have been taken to prevent and minimize the impact of such discharge; or

      (ii) consist of emergency discharges required to prevent imminent threat to human health or severe property damage, provided that reasonable and prudent measures have been taken to prevent and minimize the impact of such discharges;

   or

   c) The non-storm water discharges satisfy each of the following two conditions:

      (i) The discharges consist of uncontaminated water line flushing; potable water sources; landscape irrigation (provided all pesticides, herbicides and fertilizer have been applied in accordance with manufacturer's instructions); lawn watering; irrigation water; flows from riparian habitats and wetlands; diverted stream flows; springs; rising ground waters; uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20)) to separate storm sewers; uncontaminated pumped ground water or spring water; foundation and footing drains (where flows are not contaminated with process materials such as solvents); uncontaminated air conditioning or compressor condensate; water from crawlspace pumps; individual residential car washing; dechlorinated swimming pool discharges; routine external building wash down which does not use detergents; street and pavement wash waters, where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed); fire hydrant flushing; or flows from emergency firefighting activities; and

      (ii) The discharges are not sources of pollution to waters of the United States. A discharge is considered a source of pollution to waters of the United States if it:

         1) Contains hazardous materials in concentrations found to be of public health significance or to impair beneficial uses in receiving waters. (Hazardous materials are those

that are harmful to humans and animals from exposure, but not necessarily ingestion);

2) Contains toxic substances in concentrations that impair designated beneficial uses in receiving waters. (Toxic substances are those that can cause disease, malignancy, genetic mutation, death, or similar consequences);

3) Contains deleterious materials in concentrations that impair designated beneficial uses in receiving waters. (Deleterious materials are generally substances that taint edible species of fish, cause taste in drinking waters, or cause harm to fish or other aquatic life);

4) Contains radioactive materials or radioactivity at levels exceeding the values listed in 10 CFR Part 20 in receiving waters;

5) Contains floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or in concentrations that may impair designated beneficial uses in receiving waters;

6) Contains excessive nutrients that can cause visible slime growths or other nuisance aquatic growths that impair designated beneficial uses in receiving waters;

7) Contains oxygen-demanding materials in concentrations that would result in anaerobic water conditions in receiving waters; or

8) Contains sediment above quantities specified in IDAPA 58.01.02.250.02.e or in the absence of specific sediment criteria, above quantities that impair beneficial uses in receiving waters; or

9) Contains material in concentrations that exceed applicable natural background conditions in receiving waters (IDAPA 58.01.02.200. 09). Temperature levels may be increased above natural background conditions when allowed under IDAPA 58.01.02.401.

2. **Discharges Threatening Water Quality.** Permittees are not authorized to discharge storm water that will cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards.

3. **Snow Disposal to Receiving Waters**. Permittees are not authorized to push or dispose of snow plowed within the Permit area directly into waters of the United States, or directly into the MS4(s). Discharges from any Permittee's snow disposal and snow management practices are authorized under this Permit only when such sites and practices are designed, conducted, operated, and maintained to prevent and reduce pollutants in the discharges to the maximum

extent practicable so as to avoid excursions above the Idaho water quality standards.

4. **Storm Water Discharge Associated with Industrial and Construction Activity.** Permittees are authorized to discharge storm water associated with industrial activity (as defined in 40 CFR 122.26(b)(14)), and storm water associated with construction activity (as defined in 40 CFR 122.26(b)(14)(x) and (b)(15)), from their MS4s, only when such discharges are otherwise authorized under an appropriate NPDES permit.

II. Storm Water Management Program (SWMP) Requirements

A. General Requirements

1. **Reduce pollutants to the maximum extent practicable.** The Permittees must implement and enforce a SWMP designed to reduce the discharge of pollutants from their MS4 to the maximum extent practicable (MEP), and to protect water quality in receiving waters. The SWMP as defined in this Permit must include best management practices (BMPs), controls, system design, engineering methods, and other provisions appropriate to control and minimize the discharge of pollutants from the MS4s.

   a) **SWMP Elements**. The required SWMP control measures are outlined in Part II.SWMP assessment/monitoring requirements are described in Part IV. Each Permittee must use practices that are selected, implemented, maintained, and updated to ensure that storm water discharges do not cause or contribute to an exceedance of an applicable Idaho water quality standard.

   b) **SWMP Documentation.** Each Permittee must prepare written documentation of the SWMP as implemented within their jurisdiction. The SWMP documentation must be organized according to the program components in Parts II and IV of this Permit, and must provide a current narrative physical description of the Permittee's MS4, illustrative maps or graphics, and all related ordinances, policies and activities as implemented within their jurisdiction. Each Permittee's SWMP documentation must be submitted to EPA with the 1st Year Annual Report.

      (i) Each Permittee must provide an opportunity for public review and comment on their SWMP documentation, consistent with applicable state or local requirements and Part II.B.6 of this Permit.

      (ii) Each Permittee's SWMP documentation must be updated at least annually and submitted as part of each subsequent Annual Report. (The document format used for Annual Report(s) submitted to EPA by the Permittees' prior to the effective date of this Permit may be modified to meet this requirement.)

   c) **SWMP Information.** The SWMP must include an ongoing program for gathering, tracking, maintaining, and using information to set priorities, evaluate SWMP implementation and Permit compliance.

d) **SWMP Statistics**. Permittees must track the number of inspections, official enforcement actions and types of public education activities and outcomes as stipulated by the respective program component. This information must be included in the Annual Report.

2. **Shared Implementation with outside entities.** Implementation of one or more of the SWMP minimum control measures may be shared with or delegated to another entity other than the Permittee(s). A Permittee may rely on another entity only if:

   a) The other entity, in fact, implements the minimum control measure;

   b) The action, or component thereof , is at least as stringent as the corresponding Permit requirement; and

   c) The other entity agrees to implement the minimum control measure on the Permittee's behalf. A binding written acceptance of this obligation is required. Each Permittee must maintain and record this obligation as part of the SWMP documentation. If the other entity agrees to report on the minimum control measure, the Permittees must supply the other entity with the reporting requirements in Part IV.C of this Permit. The Permittees remain responsible for compliance with the Permit obligation if the other entity fails to implement the required minimum control measure.

3. **Modification of the SWMP**. Minor modifications to the SWMP may be made in accordance with Part II.E of this Permit.

4. **Subwatershed Planning.** No later than September 30, 2016, the Permittees must jointly complete at least two individual sub-watershed plans for areas served by the MS4s within the Permit area. For the purposes of this Permit, the terms "subwatershed" and "storm sewershed" are defined as in Part VII. For each plan document, the subwatershed planning area must drain to at least one of the water bodies listed in Table II.C.

   Selected subwatersheds must be identified in the 1st Year Annual Report. Two completed subwatershed plan documents must be submitted to EPA as part of the 4th Year Annual Report.

   a) The Permittees must actively engage stakeholders in the development of each plan, and must provide opportunities for public input, consistent with Part II.B.6.

   b) The Permittees may modify and update any existing watershed planning document(s) to address the requirements of this Part.

   c) Each subwatershed plan must describe the extent and nature of the existing storm sewershed, and identify priority aquatic resources and beneficial uses to be protected or restored within the subwatershed planning area. Each subwatershed plan must contain a prioritized list of potential locations or opportunities for protecting or restoring such resources or beneficial uses through storm water infiltration, evapotranspiration or rainfall

harvesting/reuse, or other site-based low impact development (LID) practices. See Parts II.B.2.a, and II.B.2.c.

d) Each subwatershed plan must include consideration and discussion of how the Permittees will provide incentives, or enforce requirements, through their respective Stormwater Management Programs to address the following principles:

(i) Minimize the amount of impervious surfaces (roads, parking lots, roofs) within each watershed, by minimizing the creation, extension and widening of roads and associated development.

(ii) Preserve, protect, create and restore ecologically sensitive areas that provide water quality benefits and serve critical watershed functions. These areas may include, but are not limited to; riparian corridors, headwaters, floodplains and wetlands.

(iii) Prevent or reduce thermal impacts to water bodies, including requiring vegetated buffers along waterways, and disconnecting discharges to surface waters from impervious surfaces such as parking lots.

(iv) Seek to avoid or prevent hydromodification of streams and other water bodies caused by development, including roads, highways, and bridges.

(v) Preserve and protect trees, and other vegetation with important evapotranspirative qualities.

(vi) Preserve and protect native soils, prevent topsoil stripping, and prevent compaction of soils.

B. Minimum Control Measures. The following minimum control measures must be accomplished through each Permittee's Storm Water Management Program:

1. **Construction Site Runoff Control Program.** The Permittees must implement a construction site runoff control program to reduce discharges of pollutants from public and private construction activity within its jurisdiction.

The Permittees' construction site management program must include the requirements described below:

a) **Ordinance and/or other regulatory mechanism**. To the extent allowable under local or state law, Permittees must adopt, implement, and enforce requirements for erosion controls, sediment controls, and materials management techniques to be employed and maintained at each construction project from initial clearing through final stabilization. Each Permittee must require construction site operators to maintain adequate and effective controls to reduce pollutants in storm water discharges from construction sites. The Permittees must use enforcement actions (such as, written warnings, stop work orders or fines) to ensure compliance.

No later than September 30, 2015, each Permittee must update their ordinances or other regulatory mechanisms, as necessary, to be consistent with this Permit and with the current version of the *NPDES General Permit for Storm Water Discharges from Construction Activities*, Permit #IDR12-0000 (NPDES Construction General Permit or CGP).

b) **Manuals Describing Construction Storm Water Management Controls and Specifications.** The Permittees must require construction site operators within their jurisdiction to use construction site management controls and specifications as defined within manuals adopted by the Permittees.

No later than September 30, 2015, the Permittees must update their respective manuals, as necessary, to include requirements for the proper installation and maintenance of erosion controls, sediment controls, and material containment/pollution prevention controls during all phases of construction activity. The manual(s) must include all acceptable control practices, selection and sizing criteria, illustrations, and design examples, as well as recommended operation and maintenance of each practice. At a minimum, the manual(s) must include requirements for erosion control, sediment control, and pollution prevention which complement and do not conflict with the current version of the CGP. If the manuals previously adopted by the individual Permittee do not meet these requirements, the Permittee may create supplemental provisions to include as part of the adopted manual in order to comply with this Permit.

c) **Plan Review and Approval.** The Permittees must review and approve preconstruction site plans from construction site operators within their jurisdictions. Permittees must ensure that the construction site operator is prohibited from commencing construction activity prior to receipt of written approval.

(i) The Permittees must not approve any erosion and sediment control (ESC) plan or Storm Water Pollution Prevention Plan (SWPPP) unless it contains appropriate site-specific construction site control measures meeting the Permittee's requirements as outlined in Part II.B.1.b.

(ii) Prior to the start of a construction project disturbing one or more acres, or disturbing less than one acre but is part of a larger common plan of development, the Permittees must advise the construction site operator(s) to seek or obtain necessary coverage under the NPDES Construction General Permit.

(iii) Permittees must use qualified individuals, knowledgeable in the technical review of ESC plans/SWPPPs, to conduct such reviews.

(iv) Permittees must document the review of each ESC plan and/or SWPPP using a checklist or similar process.

d) **Construction Site Inspections**. The Permittees must inspect construction sites occurring within their jurisdictions to ensure compliance with their

applicable requirements. The Permittees may establish an inspection prioritization system to identify the frequency and type of inspection based upon such factors as project type, total area of disturbance, location, and potential threat to water quality. If a prioritization system is used, the Permittee must include a description of the current inspection prioritization in the SWMP document required in Part II.A, and summarize the nature and number of inspections conducted during the previous reporting period in each Annual Report.

(i) Inspections of construction sites must include, but not be limited to:

- As applicable, a check for coverage under the Construction General Permit by reviewing any authorization letter or Notice of Intent (NOI) during initial inspections;
- Review the applicable ESC plan/SWPPP to determine if control measures have been installed, implemented, and maintained as approved;
- Assessment of compliance with the Permittees' ordinances/requirements related to storm water runoff, including the implementation and maintenance of required control measures;
- Assessment of the appropriateness of planned control measures and their effectiveness;
- Visual observation of non-storm water discharges, potential illicit connections, and potential discharge of pollutants in storm water runoff;
- Education or instruction related to on storm water pollution prevention practices, as needed or appropriate; and
- A written or electronic inspection report.

(ii) The Permittees must track the number of construction site inspections conducted throughout the reporting period, and verify that the sites are inspected at the minimum frequencies required by the inspection prioritization system. Construction site inspections must be tracked and reported with each Annual Report.

(iii) Based on site inspection findings, each Permittee must take all necessary follow-up actions (i.e., re-inspection, enforcement) to ensure compliance. Follow-up and enforcement actions must be tracked and reported with each Annual Report.

e) **Enforcement Response Policy for Construction Site Management Program**. No later than September 30, 2016, each Permittee must develop and implement a written escalating enforcement response policy (ERP) appropriate to their organization. Upon implementation of the policy in its jurisdiction, each Permittee must submit its completed ERP to EPA with the 4th Year Annual Report. The ERP for City of Boise, City of Garden City, and Ada County Highway District must address enforcement of construction site runoff controls for all currently regulated construction projects within their jurisdictions. The ERP for Idaho Transportation Department District 3, Drainage District 3, and Boise State University must address contractual enforcement of construction site runoff controls at construction sites within their jurisdictions. Each ERP must describe the Permittee's potential responses to violations with an appropriate educational or enforcement response. The ERP must address repeat violations through progressively stricter responses as needed to achieve compliance. Each ERP must describe how the Permittee will use the following types of enforcement response, as available, based on the type of violation:

(i) Verbal Warnings: Verbal warnings are primarily consultative in nature. At a minimum, verbal warnings must specify the nature of violation and required corrective action.

(ii) Written Notices: Written notices must stipulate the nature of the violation and the required corrective action, with deadlines for taking such action.

(iii) Escalated Enforcement Measures: The Permittees must have the legal ability to employ any combination of the enforcement actions below (or their functional equivalent):

- The ERP must indicate when the Permittees will initiate a Stop Work Order. Stop work orders must require that construction activities be halted, except for those activities directed at cleaning up, abating discharge, and installing appropriate control measures.
- The Permittees must also use other escalating measures provided under local or state legal authorities, such as assessing monetary penalties. The Permittees may perform work necessary to improve erosion control measures and collect the funds from the responsible party in an appropriate manner, such as collecting against the project's bond, or directly billing the responsible party to pay for work and materials.

f) **Construction General Permit Violation Referrals.** For those construction projects which are subject to the NPDES Construction General Permit and do not respond to Permittee educational efforts, the Permittee may provide to EPA information regarding construction project operators which cannot demonstrate that they have appropriate NPDES Permit

coverage and/or site operators deemed by the Permittee as not complying with the NPDES Construction General Permit. Permittees may submit such information to the EPA NPDES Compliance Hotline in Seattle, Washington, by telephone, at (206) 553-1846, and include, at a minimum, the following information:

- Construction project location and description;
- Name and contact information of project owner/ operator;
- Estimated construction project disturbance size; and
- An account of information provided by the Permittee to the project owner/ operator regarding NPDES filing requirements.

(i) **Enforcement Tracking.** Permittees must track instances of non-compliance either in hard-copy files or electronically. The enforcement case documentation must include, at a minimum, the following:

- Name of owner/operator;
- Location of construction project;
- Description of violation;
- Required schedule for returning to compliance;
- Description of enforcement response used, including escalated responses if repeat violations occur;
- Accompanying documentation of enforcement response (e.g., notices of noncompliance, notices of violations, etc.); and
- Any referrals to different departments or agencies.

g) **Construction Program Education and Training.** Throughout the Permit term, the Permittees must ensure that all staff whose primary job duties are related to implementing the construction program (including permitting, plan review, construction site inspections, and enforcement) are trained to conduct such activities. The education program must also provide regular training opportunities for construction site operators. This training must include, at a minimum:

(i) *Erosion and Sediment Control/Storm Water Inspectors*:

- Initial training regarding proper control measure selection, installation and maintenance as well as administrative requirements such as inspection reporting/tracking and the implementation of the enforcement response policy; and

- Annual refresher training for existing inspection staff to update them on preferred BMPs, regulation changes, Permit updates, and policy or standards updates.

(ii) *Other Construction Inspectors*: Initial training on general storm water issues, basic control measure implementation information, and procedures for notifying the appropriate personnel of noncompliance.

(iii) *Plan Reviewers*:

- Initial training regarding control measure selection, design standards, review procedures;

- Annual training regarding new control measures, innovative approaches, Permit updates, regulation changes and policy or standard updates.

(iv) *Third-Party Inspectors and Plan Reviewers*. If the Permittee utilizes outside parties to either conduct inspections and or review plans, these outside staff must be trained per the requirements listed in Part II.B.1.f.i.-iii above.

(v) *Construction Operator Education*. At a minimum, the Permittees must educate construction site operators within the Permit area as follows:

- At least once per year, the Permittees must either provide information to all construction companies on existing training opportunities or develop new training for construction operators regarding appropriate selection, installation, and use of required construction site control measures at sites within the Permit area.

- The Permittees must require construction site operators to have at least one person on-site during construction that is appropriately trained in erosion and sediment control.

- The Permittees must require construction operators to attend training at least once every three years.

- The Permittees must provide appropriate information and outreach materials to all construction operators who may disturb land within their jurisdiction.

2. Storm Water Management for Areas of New Development and Redevelopment. At a minimum, the Permittees must implement and enforce a program to control storm water runoff from new development and redevelopment projects that result in land disturbance of 5,000 square feet or more, excluding individual one or two family dwelling development or redevelopment. This program must apply to private and public sector development, including roads and streets. The program implemented by the Permittees must ensure that permanent controls or practices are utilized at each new development and redevelopment site to protect water quality. The program must include, at a minimum, the elements described below:

a) **Ordinance or other regulatory mechanisms**. No later than the expiration date of this Permit, each Permittee must update its applicable ordinance or regulatory mechanism which requires the installation and long-term maintenance of permanent storm water management controls at new development and redevelopment projects. Each Permittee must update their ordinance/regulatory mechanism to the extent allowed by local and state law, consistent with the individual Permittee's respective legal authority. Permittees must submit their revised ordinance/regulatory mechanism as part of the 5th Year Annual Report.

(i) The ordinance/regulatory mechanism must include site design standards for all new and redevelopment that require, in combination or alone, storm water management measures that keep and manage onsite the runoff generated from the first 0.6 inches of rainfall from a 24-hour event preceded by 48 hours of no measureable precipitation. Runoff volume reduction can be achieved by canopy interception, soil amendments, bioretention, evapotranspiration, rainfall harvesting, engineered infiltration, extended filtration, and/or any combination of such practices that will capture the first 0.6 inches of rainfall. An Underground Injection Control permit may be required when certain conditions are met. The ordinance or regulatory mechanism must require that the first 0.6 inches of rainfall be 100% managed with no discharge to surface waters, except when the Permittee chooses to implement the conditions of II.B.2.a.ii below.

(ii) For projects that cannot meet 100% infiltration/evapotranspiration/reuse requirements onsite, the Permittees' program may allow offsite mitigation within the same subwatershed, subject to siting restrictions established by the Permittee. The Permittee allowing this option must develop and apply criteria for determining the circumstances under which offsite mitigation may be allowed. A determination that the onsite retention requirement cannot be met must be based on multiple factors, including but not limited to technical feasibility or logistic practicality (e.g. lack of available space, high groundwater, groundwater contamination, poorly infiltrating soils, shallow bedrock, and/or a land use that is inconsistent with

capture and reuse or infiltration of storm water). Determinations may not be based solely on the difficulty and/or cost of implementing such measures. The Permittee(s) allowing this option must create an inventory of appropriate mitigation projects and develop appropriate institutional standards and management systems to value, estimate and track these situations. Using completed subwatershed plans or other mechanisms, the Permittee(s) must identify priority areas within subwatersheds in which off-site mitigation may be conducted.

(iii) The ordinance or regulatory mechanism must include the following water quality requirements:

- Projects with potential for excessive pollutant loading(s) must provide water quality treatment for associated pollutants before infiltration.
- Projects with potential for excessive pollutant loading(s) that cannot implement adequate preventive or water quality treatment measures to ensure compliance with Idaho surface water standards must properly convey storm water to a NPDES permitted wastewater treatment facility or via a licensed waste hauler to a permitted treatment and disposal facility.

(iv) The ordinance or other regulatory mechanism must include procedures for the Permittee's review and approval of permanent storm water management plans for new development and redevelopment projects consistent with Part II.B.1.d.

(v) The ordinance or other regulatory mechanism must include sanctions (including fines) to ensure compliance, as allowed under state or local law.

b) **Storm Water Design Criteria Manual.** No later than September 30, 2015, each Permittee must update as necessary their existing Storm Water Design Criteria Manual specifying acceptable permanent storm water management and control practices. The manual must contain design criteria for each practice. In lieu of updating a manual, a Permittee may adopt a manual created by another entity which complies with this section. The manual must include:

(i) Specifications and incentives for the use of site-based practices appropriate to local soils and hydrologic conditions;

(ii) A list of acceptable practices, including sizing criteria, performance criteria, design examples, and guidance on selection and location of practices; and

(iii) Specifications for proper long term operation and maintenance, including appropriate inspection interval and self-inspection checklists for responsible parties.

c) **Green Infrastructure/Low Impact Development (LID) Incentive Strategy and Pilot Projects**. No later than September 30, 2015, the Permittees must develop a strategy to provide incentives for the increased use of LID techniques in private and public sector development projects within each Permittee's jurisdiction. Permittees must comply with applicable State and local public notice requirements when developing this Strategy. Pursuant to Part IV.A.2.a, the Strategy must reference methods of evaluating at least three (3) Green Infrastructure/LID pilot projects as described below. Permittees must implement the Green Infrastructure/LID Incentive Strategy, and complete an effectiveness evaluation of at least three pilot projects, prior to the expiration date of this Permit.

(i) As part of the 3rd Year Annual Report, the Permittees must submit the written Green Infrastructure /LID Incentive Strategy; the Strategy must include a description of at least three selected pilot projects, and a narrative report on the progress to evaluate the effectiveness of each selected LID technique or practice included in the pilot project. Each pilot project must include an evaluation of the effectiveness of LID technique(s) or practice(s) used for on-site control of water quality and/or quantity. Each Pilot Project must involve at least one or more of the following characteristics:

- The project manages runoff from at least 3,000 square feet of impervious surface;
- The project involves transportation related location(s) (including parking lots);
- The drainage area of the project is greater than five acres in size; and/or
- The project involves mitigation of existing storm water discharges to one or more of the water bodies listed in Table II.C.

(ii) Consistent with Part IV.A.10, the Permittees must evaluate the performance of LID technique(s) or practice(s) in each pilot project, and include a progress report on overall strategy implementation in the 4th Annual Report. Final pilot project evaluations must be submitted in the 5th Year Annual Report. The Permittees must monitor, calculate or model changes in runoff quantities for each of the pilot project sites in the following manner:

- For retrofit projects, changes in runoff quantities shall be calculated as a percentage of 100% pervious surface before and after implementation of the LID technique(s) or practice(s).
- For new construction projects, changes in runoff quantities shall be calculated for development scenarios both with LID technique(s) or practice(s) and without LID technique(s) or practice(s).

- The Permittees must measure runoff flow rate and subsequently prepare runoff hydrographs to characterize peak runoff rates and volumes, discharge rates and volumes, and duration of discharge volumes. The evaluation must include quantification and description of each type of land cover contributing to surface runoff for each pilot project, including area, slope, vegetation type and condition for pervious surfaces, and the nature of impervious surfaces.
- The Permittees must use these runoff values to evaluate the overall effectiveness of various LID technique(s) or practice(s) and to develop recommendations for future adoption of LID technique(s) or practice(s) that address appropriate use, design, type, size, soil type and operation and maintenance practices.

(iii) **Riparian Zone Management and Outfall Disconnection.** No later than September 30, 2015, the Permittees must identify and prioritize riparian areas appropriate for Permittee acquisition and protection. Prior to the expiration date of this Permit, the Permittees must undertake and complete at least one project designed to reduce the flow of untreated urban storm water discharging through the MS4 system through the use of vegetated swales, storm water treatment wetlands and/or other appropriate techniques. The Permittees must submit the list of prioritized riparian protection areas, and a status report on the planning and implementation of the outfall disconnection project, as part of the 3rd Year Annual Report. Documentation of the completed outfall disconnection project must be included in the 5th Year Annual Report.

(iv) **Repair of Public Streets, Roads and Parking Lots.** When public streets, roads or parking lots are repaired (as defined in Part VII), the Permittees performing these repairs must evaluate the feasibility of incorporating runoff reduction techniques into the repair by using canopy interception, bioretention, soil amendments, evaporation, rainfall harvesting, engineered infiltration, rain gardens, infiltration trenches, extended filtration and/or evapotranspiration and/or any combination of the aforementioned practices. Where such practices are found to be technically feasible, the Permittee performing the repair must use such practices in the design and repair. These requirements apply only to projects whose design process is started after the effective date of this Permit. As part of the 5th Year Annual Report, the Permittees must list the locations of street, road and parking lot repair work completed since the effective date of the Permit that have incorporated such runoff reduction practices, and the receiving water body(s) benefitting from such practices. This documentation must include a general description of the project design, estimated total cost, and estimates of total flow

volume and pollutant reduction achieved compared to traditional design practices.

d) **Plan Review and Approval.** The Permittees must review and approve pre-construction plans for permanent storm water management. The Permittees must review plans for consistency with the ordinance/regulatory mechanism and Storm Water Design Criteria Manual required by this Part. The Permittees must ensure that the project operator is prohibited from commencing construction activity prior to receipt of written approval from the Permittee.

(i) The Permittees must not approve or recommend for approval any plans for permanent storm water controls that do not contain appropriate permanent storm water management practices that meet the minimum requirements specified in this Part.

(ii) Permittees must use qualified individuals, knowledgeable in the technical review of plans for permanent storm water controls to conduct such reviews.

(iii) Permittees must document the review of each plan using a checklist or similar process.

e) **Operation and Maintenance (O&M) of Permanent Storm Water Management Controls.**

(i) **Inventory and Tracking.** The Permittees must maintain a database tracking all new public and private sector permanent storm water controls. No later than January 30, 2018, all of the available data on existing permanent storm water controls known to the Permittees must be included in the inventory database. For the purposes of this Part, new permanent controls are those installed after February 1, 2013; existing permanent controls are those installed prior to February 1, 2013. The tracking must begin in the plan review stage with a database that incorporates geographic information system (GIS) information. The tracking system must also include, at a minimum: type and number of practices; O&M requirements, activity and schedule; responsible party; and self-inspection schedule.

(ii) **O&M Agreements.** Where parties other than the Permittees are responsible for operation and maintenance of permanent storm water controls, the Permittees must require a legally enforceable and transferable O&M agreement with the responsible party, or other mechanism, that assigns permanent responsibility for maintenance of structural or treatment control storm water management practices.

f) **Inspection and Enforcement of Permanent Storm Water Management Controls.** The Permittees must ensure proper long term operation and

maintenance of all permanent storm water management practices within the Permittees' respective jurisdiction. The Permittees must implement an inspection program, and define and prioritize new development and redevelopment sites for inspections of permanent storm water management controls. Factors used to prioritize sites must include, but not be limited to: size of new development or redevelopment area; sensitivity and/or impaired status of receiving water(s); and, history of non-compliance at the site during the construction phase.

(i) No later than September 30, 2017, all high priority locations must be inventoried and associated inspections must be scheduled to occur at least once annually. The inspections must determine whether storm water management or treatment practices have been properly installed (i.e., an "as built" verification). The inspections must evaluate the operation and maintenance of such practices, identify deficiencies and potential solutions, and assess potential impacts to receiving waters.

(ii) No later than September 30, 2017, the Permittees must develop checklists to be used by inspectors during these inspections, and must maintain records of all inspections conducted on new development and redevelopment sites.

(iii) No later than September 30, 2017, the Permittees must develop and implement an enforcement strategy similar to that required in Section II.B.1.e to maintain the integrity of permanent storm water management and treatment practices.

g) **Education and Training on Permanent Storm Water Controls**. No later than September 30, 2015, the Permittees must begin a training program for appropriate audiences regarding the selection, design, installation, operation and maintenance of permanent storm water controls. The training program and materials must be updated as necessary to include information on updated or revised storm water treatment standards, design manual specifications, Low Impact Development techniques or practices, and proper operation and maintenance requirements.

(i) No later than September 30, 2016, and annually thereafter, all persons responsible for reviewing plans for new development and redevelopment and/or inspecting storm water management practices and treatment controls must receive training sufficient to determine the adequacy of storm water management and treatment controls at proposed new development and redevelopment sites.

(ii) No later than September 30, 2016, and at least annually thereafter, Permittees must provide training to local audiences on the storm water management requirements described in this Part.

3. Industrial and Commercial Storm Water Discharge Management. The Permittees must implement a program to reduce to the MEP the discharge of pollutants from industrial and commercial operations within their jurisdiction. Throughout the Permit term, the Permittees must conduct educational and/or enforcement efforts to reduce the discharge of pollutants from those industrial and commercial locations which are considered to be significant contributors of phosphorus, bacteria, temperature, and/or sediment to receiving waters. At a minimum, the program must include the following elements:

a) **Inventory of Industrial and Commercial Facilities/Activities**. No later than September 30, 2016, the Permittees must update the inventory and map of facilities and activities discharging directly to their MS4s.

(i) At a minimum, the inventory must include information listing the watershed/receiving water body, facility name, address, nature of business or activity, and North American or Standard Industrial Classification code(s) that best reflect the facility's product or service;

(ii) The inventory must include the following types of facilities: municipal landfills (open and closed); Permittee-owned maintenance yards and facilities; hazardous waste recovery, treatment, storage and disposal facilities; facilities subject to Section 313 of the Emergency Planning and Community Right-to-Know Act, 42 U.S.C. 11023; all industrial sectors listed in 40 CFR §122.26(b)(14); vehicle or equipment wash systems; commercial animal facilities, including kennels, race tracks, show facilities, stables, or other similar commercial locations where improper management of domestic animal waste may contribute pollutants to receiving waters or to the MS4; urban agricultural activities; and other industrial or commercial facility that the Permittees determine is contributing a substantial pollutant loading to the MS4 and associated receiving waters.

(iii) The Permittees must collectively identify at least two specific industrial/commercial activities or sectors operating within the Permit area for which storm water discharges are not being adequately addressed through existing programs. No later than September 30, 2016, the Permittees must develop best management practices for each activity, and educate the selected industrial/commercial audiences regarding these performance expectations. Example activities for consideration include, but are not limited to: landscaping businesses; wholesale or retail agricultural and construction supply businesses; urban agricultural activities; power washers; commercial animal facilities; commercial car/truck washing operations; and automobile repair shops.

b) **Inspection of Industrial and Commercial Facilities/Activities**. The Permittees must work cooperatively throughout the Permit term to prioritize

and inspect selected industrial and commercial facilities/activities which discharge to receiving waters or to the MS4. No later than September 30, 2016, any existing agreements between the Permittees to accomplish such inspections must be updated as necessary to comply with this permit. At a minimum, the industrial and commercial facility inspection program must include:

(i) Priorities and procedures for inspections, including inspector training, and compliance assistance or education materials to inform targeted facility/activity operators of applicable requirements;

(ii) Provisions to record observations of a facility or activity;

(iii) Procedures to report findings to the inspected facility or activity, and to follow-up with the facility/activity operator as necessary;

(iv) A monitoring (or self monitoring) program for facilities that assesses the type and quantity of pollutants discharging to the MS4s;

(v) Procedures to exercise legal authorities to ensure compliance with applicable local storm water ordinances.

c) **Maintain Industrial and Commercial Facility/Activity Inventory**. The industrial and commercial facility/activity inventory must be updated at least annually. The updated inventory and a summary of the compliance assistance and inspection activities conducted, as well as any follow-up actions, must be submitted to EPA with each Annual Report.

4. Storm Water Infrastructure and Street Management. The Permittees must maintain their MS4 and related facilities to reduce the discharge of pollutants from the MS4 to the MEP. All Permittee-owned and operated facilities must be properly operated and maintained. This maintenance requirement includes, but is not limited to, structural storm water treatment controls, storm sewer systems, streets, roads, parking lots, snow disposal sites, waste facilities, and street maintenance and material storage facilities. The program must include the following:

a) **Storm Sewer System Inventory and Mapping**. No later than January 30, 2018, the Permittees must update current records to develop a comprehensive inventory and map of the MS4s and associated outfall locations. The inventory must identify all areas over which each Permittee has responsibility. The inventory must include:

(i) the location of all inlets, catch basins and outfalls owned/operated by the Permittee;

(ii) the location of all MS4 collection system pipes (laterals, mains, etc.) owned/operated by the Permittee, including locations where the MS4 is physically interconnected to the MS4 of another operator ;

(iii) the location of all structural flood control devices, if different from the characteristics listed above;

(iv) the names and locations of receiving waters of the U.S. that receive discharges from the outfalls;

(v) the location of all existing structural storm water treatment controls;

(vi) identification of subwatersheds, associated land uses, and approximate acreage draining into each MS4 outfall; and

(vii) the location of Permittee-owned vehicle maintenance facilities, material storage facilities, maintenance yards, and snow disposal sites; Permittee-owned or operated parking lots and roadways.

A summary description of the Permittees' storm sewer system inventory and a map must be submitted to EPA as part of the reapplication package required by Part VI.B

b) **Catch Basin and Inlet Cleaning.** No later than September 30, 2016, the Permittees must initiate an inspection program to inspect all Permittee-owned or operated catch basins and inlets at least every two years and take appropriate maintenance action based on those inspections. Inspection records must be maintained and summarized in each Annual Report.

c) **Street and Road Maintenance.** No later than September 30, 2015, the Permittees responsible for road and street maintenance must update any standard operating procedures for storm water controls to ensure the use of BMPs that, when applied to the Permittee's activity or facility, will protect water quality, and reduce the discharge of pollutants to the MEP. The operating procedures must contain, for each activity or facility, inspection and maintenance schedules specific to the activity, and appropriate pollution prevention/good housekeeping procedures for all of the following types of facilities and/or activities listed below. Water conservation measures should be considered for all landscaped areas.

(i) **Streets, roads, and parking lots**. The procedures must address, but are not limited to: road deicing, anti-icing, and snow removal practices; snow disposal areas; street/road material (e.g. salt, sand, or other chemical) storage areas; maintenance of green infrastructure/low impact development practices; and BMPs to reduce road and parking lot debris and other pollutants from entering the MS4. Within four years of the effective date of this permit, the Permittees must implement all of the pollution prevention/good housekeeping practices established in the SOPs for all streets, roads, highways, and parking lots with more than 3,000 square feet of impervious surface that are owned, operated, or maintained by the Permittees.

(ii) **Inventory of Street Maintenance Materials.** Throughout the Permit term, all Permittees with street maintenance

responsibilities must maintain an inventory of street /road maintenance materials, including use of sand and salt, and document the inventory in the corresponding Annual Reports.

(iii) **Manage Sand with Salt and Salt Storage Areas.** No later than September 30, 2017, the Permittees must address any sand, salt, or sand with salt material stockpiles at each of their materials storage locations to prevent pollutants in stormwater runoff from discharging to the MS4 or into any receiving waterbody. Examples how the Permittee may choose to address runoff from their material storage areas include, but are not limited to: building covered storage areas; fully containing the material stockpile area in a manner that prevents runoff from discharging to the MS4 or a receiving waterbody; relocating and/or otherwise consolidating material storage piles to alternative locations which prevents discharges to the MS4 or a receiving waterbody. The Permittees must identify their material storage locations in the SWMP documentation submitted to EPA with the 1st year Annual Report and reference the average quantity of material stored at each location in the inventory required in Part II.B.4.c.ii. Permittees must document in the 5th Year Annual Report how their material stockpiles have been addressed to prevent runoff from discharging to the MS4 or a receiving waterbody.

d) **Street, Road and Parking Lot Sweeping**. Each Permittee with street, road, and/or public parking lot maintenance responsibilities must update their respective sweepings management plans no later than September 30, 2015. Each updated plan must designate all streets, roads, and/or public parking lots which are owned, operated or maintained by that Permittee to fit within one of the following categories for sweeping frequency based on land use, traffic volumes or other factors:

- Residential – Streets and road segments that include, but are not limited to, light traffic zones and residential zones.
- Arterial and all other – Streets and road segments with high traffic volumes serving commercial or industrial districts.
- Public Parking Lots – large lots serving schools and cultural facilities, plazas, sports and event venues or similar facilities.

(i) No later than September 30, 2014, each Permittee with street, road, and/or public parking lot maintenance responsibilities must inventory and map all of their designated streets, roads, and public parking lots for sweeping frequency. The resulting inventory and map must be submitted as part of the 2nd Year Annual Report.

(ii) No later than September 30, 2015, Permittees with street, road, and/or public parking lot maintenance responsibilities must

sweep all streets, roads, and public parking lots that are owned, operated or maintained by that Permittee according to the following schedule:

Table II.B-2

Roadway Type	Sweeping Schedule			
	Two Times Per Month	**Every Six Weeks**	**Four Times Per Year**	**One Time Per Year**
Downtown Areas of Boise and Garden City	**X**			
Arterial and Collector Roadways (non-downtown)		**X**		
Residential Roadways			**X**	
Paved Alleys and Public Parking Lots				**X**

(iii) If a Permittee's existing overall street/road/parking lot sweeping program provides equivalent or greater street sweeping frequency to the requirements above, the Permittee must continue to implement its existing street/road/parking lot sweeping program.

(iv) For areas where sweeping is technically infeasible, the Permittees with street, road, and/or public parking lot maintenance responsibilities must document in the 1st Year Annual Report each area and indicate why sweeping is infeasible. The Permittee must document what alternative sweeping schedule will be used, or how the Permittee will increase implementation of other trash/litter control procedures to minimize pollutant discharges to the MS4 and to receiving waters.

(v) The Permittees with street, road, and/or public parking lot maintenance responsibilities must estimate the effectiveness of their street sweeping activities to minimize pollutant discharges to the MS4 and receiving waters, and document the following in each Annual Report:

- Identify any significant changes to the designated road/street/parking lot inventory and map, and the basis for those changes;
- Report annually on types of sweepers used, swept curb and/or lane miles, dates of sweeping by general location and frequency category, volume or weight of materials removed and a representative sample of the particle size distribution of swept material;
- Report annually on any public outreach efforts or other means to address excess leaves and other material as well as areas that are infeasible to sweep.

e) **Implement appropriate requirements for pesticide, herbicide, and fertilizer applications**. Permittees must continue to implement practices to reduce the discharge of pollutants to the MS4 associated with the application, storage and disposal of pesticides, herbicides and fertilizers from municipal areas and activities. Municipal areas and activities include, at a minimum, municipal facilities, public right-of-ways, parks, recreational facilities, golf courses, and landscaped areas. All employees or contractors of the Permittees applying restricted use pesticides must be registered as certified applicators.

f) **Develop and implement Storm Water Pollution Prevention Plans.** No later than September 30, 2015, the Permittees must develop and implement SWPPPs for all Permittee-owned material storage facilities, and maintenance yards located within the Permit area and identified in the inventory required in Parts II.B.3.a and II.B.4.a.viii. Permittee-owned facilities discharging storm water associated with industrial activity as defined in 40 CFR 122.26(b)(14) must obtain separate NPDES permit coverage as required in Part I.D.4 of this permit.

g) **Storm Water Management.** Each Permittee must ensure that any storm water management projects it undertakes after the effective date of this Permit are designed and implemented to prevent adverse impacts on water quality.

(i) Permittees must evaluate the feasibility of retrofitting existing storm water control devices to provide additional pollutant removal from collected storm water.

(ii) No later than the expiration date of this Permit, Permittees must identify and define all locations where such retrofit project opportunities are feasible, identify appropriate funding sources, and outline project timelines or schedule(s) for retrofit projects designed to better control the discharge of pollutants of concern to the Boise River and its tributaries.

h) **Litter Control.** Throughout the Permit term, each Permittee must continue to implement effective methods to reduce litter within their jurisdiction. Permittees must work with others as appropriate to control litter on a

regular basis and after major public events to reduce the discharge of pollutants to receiving waters.

i) **Training.** The Permittees must provide regular training to appropriate Permittee staff on all operations and maintenance procedures designed to prevent pollutants from entering the MS4 and receiving waters. Appropriate Permittee staff must receive training no later than September 30, 2015, and annually thereafter.

5. Illicit Discharge Management. An illicit discharge is any discharge to an MS4 that is not composed entirely of storm water. Exceptions are described in Part I.D. of this permit. The Permittees must continue to implement their illicit discharge management program to reduce to the MEP the unauthorized and illegal discharge of pollutants to the MS4. The program must include:

a) **Ordinance or other regulatory mechanisms.** Upon the effective date of this Permit, the Permittees must effectively prohibit non-storm water discharges to the MS4 (except those identified in Part 1.D of this permit) through enforcement of relevant ordinances or other regulatory mechanisms. Such ordinances/regulatory mechanisms must be updated prior to the expiration date of this Permit as necessary to provide adequate controls. To be considered adequate, an ordinance or regulatory mechanism must:

(i) Authorize the Permittee to prohibit, at a minimum, the following discharges to the MS4, unless otherwise authorized in Part 1.D:

- Sewage;
- Discharges of wash water resulting from the hosing or cleaning of gas stations, auto repair garages, or other types of automotive services facilities;
- Discharges resulting from the cleaning, repair, or maintenance of any type of equipment, machinery, or facility, including motor vehicles, cement-related equipment, and port-a-potty servicing, etc.;
- Discharges of wash water from mobile operations, such as mobile automobile or truck washing, steam cleaning, power washing, and carpet cleaning, etc.;
- Discharges of wash water from the cleaning or hosing of impervious surfaces in municipal, industrial, commercial, and residential areas - including parking lots, streets, sidewalks, driveways, patios, plazas, work yards and outdoor eating or drinking areas, etc. - where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed);
- Discharges of runoff from material storage areas containing chemicals, fuels, grease, oil, or other hazardous materials;

- Discharges of pool or fountain water containing chlorine, biocides, or other chemicals; discharges of pool or fountain filter backwash water;
- Discharges of sediment, pet waste, vegetation clippings, or other landscape or construction-related wastes; and
- Discharges of food-related wastes (grease, fish processing, and restaurant kitchen mat and trash bin wash water, etc.).

(ii) Prohibit and eliminate illicit connections to the MS4;

(iii) Control the discharge of spills, and prohibit dumping or disposal of materials other than storm water into the MS4.

b) **Illicit Discharge Complaint Reporting and Response Program.** At a minimum, Permittees must respond to reports of illicit discharges from the public in the following manner:

(i) **Complaint/ReportingHotline.** The Permittees must maintain the dedicated telephone number and email address, or other publicly available and accessible means in addition to the website required in Part II.B.6, for use by the public to report illicit discharges. This complaint hotline must be answered by trained staff during normal business hours. During non-business hours, a system must be in place to record incoming calls to the hotline and a system must be in place to guarantee timely response. The telephone number must be printed on appropriate education, training, and public participation materials produced under Part II.B.6, and clearly listed in the local telephone book as appropriate.

(ii) **Response to Complaints/Reports.** The Permittees must respond to all complaints or reports of illicit discharges as soon as possible, but no later than within two working days.

(iii) **Maintain log of complaints/reports received and actions taken.** The Permittees must maintain a record documenting all complaints or reports of illicit discharges and responses taken by the Permittees.

c) **Illicit Discharge Mapping.** No later than September 30, 2014, the Permittees must develop a map of reported and documented illicit discharges or illicit connections to identify priority areas. The map must identify, at a minimum, the location, type and relative quantity or severity of the known, recurrent or ongoing non-storm water discharges to the MS4. This map must be updated annually and used to target the specific outfall locations for that field screening season.

d) **Dry Weather Outfall Screening Program.** Permittees must implement, and update as necessary, a dry weather analytical and field screening monitoring program. This dry weather outfall screening program must emphasize frequent, geographically widespread monitoring to detect illicit discharges and illegal connections, and to reinvestigate potentially

problematic outfalls. At a minimum, the procedures must be based on the following guidelines and criteria:

(i) **Outfall Identification.** The Permittees must update as necessary the storm water outfall identification and screening plan, describing the reconnaissance activities that must be performed and information used to prioritize targeted outfalls and associated land uses.. The plan must discuss how chemical and microbiological analysis will be conducted on any flows identified during dry weather screening, including field screening methodologies and associated trigger thresholds to be used for determining follow-up action.

(ii) **Monitoring Illicit Discharges.** No later than September 30, 2015, dry weather analytical and field screening monitoring must be conducted at least once annually (or more often if the Permittees deem necessary). One third of the outfalls to be screened annually must be conducted within the June 1 and September 30th timeframe.

- Upon the effective date of the Permit, the Permittees must conduct visual dry weather screening of at least 20% of their total outfalls per year.
- The outfalls must be geographically dispersed across the MS4 and must represent all major land uses in the Permit area. In addition, the Permittees must ensure that dry weather screening includes, but is not limited to, screening of 20% outfalls discharging to impaired waters listed in Table II.C.
- When flows during dry weather are identified the Permittees must collect grab samples of the discharge for in-field analysis of the following indicator constituents: pH; total chlorine; detergents as surfactants; total copper; total phenols; *E. coli*; total phosphorus; turbidity; temperature; and suspended solids concentrations (to be measured in mg/L).
- Photos may be used to document conditions.
- Results of field sampling must be compared to established trigger threshold levels and/or existing state water quality standards. If the outfall is dry (no flowing or ponded runoff), the Permittees must make and record all applicable visual observations.
- All dry weather flows previously identified or documented by the Permittees to be associated with irrigation flows or ground water seepage must be sampled to assess pollutant loading associated with such flows. The results must be evaluated to identify feasible actions necessary to eliminate such flows and ensure compliance with Part I.D of this Permit. If field sample

results of such irrigation or groundwater seepage comply with Part I.D of this permit, annual sampling of that dry weather flow at that outfall is no longer required. Permittees must document in the SWMP document the specific location(s) of outfalls associated with these results as well as the Permittee's rationale for the conclusion to discontinue future dry weather screening at that location..

(iii) **Maintain Records of Dry Weather Screening.** The Permittees must keep detailed records of the dry weather screening with the following information at a minimum: time since last rain event; quantity of last rain event; site description (e.g., conveyance type, dominant watershed land uses); flow estimation (e.g., width of water surface, approximate depth of water, approximate flow velocity, flow rate); visual observations (e.g., odor, color, clarity, floatables, deposits/stains, vegetation condition, structural condition, and biology); results of any in field sampling; and recommendations for follow-up actions to address identified problems, and documentation of completed follow-up actions.

e) **Follow-up.** The Permittees must investigate recurring illicit discharges identified as a result of complaints or as a result of dry weather screening inspections and sampling within fifteen (15) days of its detection to determine the source. Permittees must take appropriate action to address the source of the ongoing illicit discharge within 45 days of its detection.

f) **Prevent and Respond to Spills to the MS4.** Throughout the Permit term, the Permittees must coordinate appropriate spill prevention, containment and response activities throughout all appropriate departments, programs and agencies to ensure maximum water quality protection at all times. The Permittees must respond to, contain and clean up all sewage and other spills that may discharge into the MS4 from any source (including private laterals and failing septic systems).

g) **Facilitate Disposal of Used Oil and Toxic Materials.** The Permittees must continue to coordinate with appropriate agencies to ensure the proper management and disposal or recycling of used oil, vehicle fluids, toxic materials, and other household hazardous wastes by their employees and the public. Such a program must include educational activities, public information activities, and establishment of collection sites operated by the Permittees or other entity. The program must be implemented throughout the Permit term.

h) **Training.** No later than September 30, 2014, and annually thereafter, the Permittees must develop and provide training to staff on identifying and eliminating illicit discharges, spill, and illicit connections to the MS4. At a minimum, the Permittee's construction inspectors, maintenance field staff, and code compliance officers must be sufficiently trained to respond to illicit discharges and spills to the MS4.

6. Education, Outreach and Public Involvement.

a) **Comply with Applicable Requirements.** The Permittees must comply with applicable State and local public notice requirements when implementing their SWMP public involvement activities.

b) **Implement an Ongoing Education Outreach and Involvement Program.** The Permittees must conduct, or contract with other entities to conduct, an ongoing joint education, outreach and public involvement program aimed at residents, businesses, industries, elected officials, policy makers, and Permittee planning staff /other employees.

The goal of the education and outreach program is to reduce or eliminate behaviors and practices that cause or contribute to adverse storm water impacts. The goal of the public involvement program is to engage interested stakeholders in the development and implementation of the Permittees' SWMP activities to the extent allowable pursuant to the respective authority granted individual Permittees under Idaho law.

The Permittees' joint education and public involvement program must be designed to improve each target audience's understanding of the selected storm water issues, engage stakeholders, and help target audiences understand what they can do to positively impact water quality by preventing pollutants from entering the MS4.

(i) No later than September 30, 2014, the Permittees must implement or participate in an education, outreach and public involvement program using a variety of methods to target each of the audiences and at least one or more of the topics listed below:

1) General Public

- Watershed characteristics and subwatershed planning efforts as required in Part II.A.4;
- General impacts of storm water flows into surface water;
- Impacts from impervious surfaces;
- Source control best management practices and environmental stewardship, actions and opportunities for pet waste control/disposal, vehicle maintenance, landscaping and vegetative buffers;
- Water wise landscaping, water conservation, water efficiency.

2) General public and businesses, including home based and mobile businesses

- Best management practices for use and storage of automotive chemicals, hazardous cleaning supplies, vehicle wash soaps and other hazardous materials;

- Proper use and application of pesticides, herbicides and fertilizers;
- Impacts of illicit discharges and how to report them;
- Water wise landscaping, water conservation, water efficiency.

3) Homeowners, homeowner's associations, landscapers, and property managers
   - Yard care techniques protective of water quality, such as composting;
   - Best management practices for use and storage of pesticides, herbicides, and fertilizers;
   - Litter and trash control and recycling programs;
   - Best management practices for power washing, carpet cleaning and auto repair and maintenance;
   - Low Impact Development techniques, including site design, pervious paving, retention of mature trees and other vegetation;
   - Storm water treatment and flow/volume control practices;
   - Water wise landscaping, water conservation, water efficiency.
4) Engineers, contractors, developers, review staff, and land use planners
   - Technical standards for storm water site plans;
   - Low Impact Development techniques, including site design, pervious paving, retention of mature trees and other vegetation;
   - Storm water treatment and flow/volume control practices;
   - Water wise landscaping, water conservation, water efficiency.
5) Urban farmers and managers of public and private community gardens
   - Water wise landscaping, water conservation, and water efficiency.

(ii) The Permittees must assess, or participate in an effort to assess understanding and adoption of behaviors by the target audiences.

The resulting assessments must be used to direct storm water education and outreach resources most effectively.

(iii) The Permittees must track and maintain records of public education, outreach and public involvement activities.

c) **Targeted Education and Training.** For the specific topics identified in the Permit sections listed below, the Permittees must develop and implement, or contract with other entities to implement, targeted training programs to educate appropriate Permittee staff or other audiences within their jurisdiction. Where joint, cooperative education efforts to address these topics are not feasible, the individual Permitttee must ensure that the necessary education and training occurs for the following topics:

(i) II.B.1.f - Construction Storm Water Management Training for construction site operators and Permittee staff;

(ii) II.B.2.g – Permanent Storm Water Control Training for project operators and Permittee staff;

(iii) II.B.4.i– Storm Water Infrastructure and Street Management/ Maintenance training for the Permittee staff; and

(iv) II.B.5.h – Illicit Discharge Management Training for Permittee staff.

d) **Storm Water Website.** The Permittees must maintain and promote at least one publicly-accessible website that identifies each Permittee's SWMP activities and seeks to educate the audiences listed in Part II.B.6.b.i. The website(s) must describe and provide relevant information regarding the activities of all Permittees. The website must be updated no later than February 1, 2014, and updated at least quarterly thereafter as new material is available. The website must incorporate the following features:

(i) All reports, plans, or documents generated by each Permittee in compliance with this Permit must be posted on the website in draft form when input from the public is being solicited, and in final form when the document is completed.

(ii) Information and/or links to key sites that provide education, training, licensing, and permitting related to construction and post-construction storm water management controls and requirements for each jurisdiction. The website must include links to all applicable ordinances, policies and/or guidance documents related to the Permittees' construction and post-construction stormwater management control programs.

(iii) Information and/or links to appropriate controls for industrial and commercial activities,

(iv) Information and/or links to assist the public to report illicit connections and illegal dumping activity;

(v) Appropriate Permittee contact information, including phone numbers for relevant staff and telephone hotline, mailing addresses, and electronic mail addresses.

C. Discharges to Water Quality Impaired Receiving Waters.

1. The Permittees must conduct a storm water discharge monitoring program as required in Part IV.
2. For the purposes of this Permit and as listed in Table II.C, the Clean Water Act §303 (d) listed water bodies are those cited in the IDEQ 2010 Integrated Report including, but not limited to the Lower Boise River, and its associated tributaries. "Pollutant(s) of concern" refer to the pollutant(s) identified as causing or contributing to the water quality impairment. Pollutants of concern for the purposes of this Permit are: total phosphorus, sediment, temperature, and *E. coli*.
3. Each Permittees' SWMP documentation must include a description of how the activities of each minimum control measure in Part II.B are implemented by the Permittee to control the discharge of pollutants of concern and ensure that the MS4 discharges will not cause or contribute to an excursion above the applicable Idaho water quality standards. This discussion must specifically identify how the Permittee evaluates and measures the effectiveness of the SWMP to control the pollutants of concern. For those activities identified in Part II.B requiring multiple years to develop and implement, the Permittee must provide interim updates on progress to date. Consistent with Part II.A.1.b, each Permittee must submit this description of the SWMP implementation to EPA and IDEQ as part of the 1st Year Annual Report required in Part IV.C, and must update its description annually in subsequent Annual Reports.

Table II.C

Clean Water Act §303 (d) listed Water Bodies and Pollutants of Concern

Receiving Water Body Assessment Unit/ Description	Pollutants of Concern Causing Impairment
ID17050114SW011a_06 ***Boise River – Diversion Dam to River Mile 50***	Temperature
ID17050114SW005_06 ***Boise River – River Mile 50 to Star Bridge***	Temperature, Sediment, *E. coli.*
ID17050114SW005_06a ***Boise River – Star to Middleton***	Temperature, Sediment, *E. coli.*
ID17050114SW005_06b ***Boise River- Middleton to Indian Creek***	Temperature, Total phosphorus, Sediment, *E. coli.*
ID17050114SW001_06 ***Boise River- Indian Creek to the mouth***	Temperature, Total phosphorus, Sediment, *E. coli.*
ID17050114SW008_03 ***Tenmile Creek - 3rd order below Blacks Creek Reservoir***	Sediment, *E. coli.*
ID17050114SW010_02 ***Fivemile Creek - 1st & 2nd order tributaries***	*E. coli.*
ID17050114SW010_03 ***Fivemile Creek - 3rd order tributaries***	Sediment, *E. coli.*

D. Reviewing and Updating the SWMP.

1. Permittees must annually review their SWMP actions and activities for compliance with this Permit as part of the preparation of the Annual Report required under Part IV.C.2.

2. Permittees may request changes to any SWMP action or activity specified in this Permit in accordance with the following procedures:
   a) Changes to delete or replace an action or activity specifically identified in this Permit with an alternate action or activity may be requested by the Permittees at any time. Modification requests to EPA must include:
      (i) An analysis of why the original action or activity is ineffective, infeasible, or cost prohibitive;
      (ii) Expectations on the effectiveness of the replacement action or activity; and
      (iii) An analysis of why the replacement action or activity is expected to better achieve the Permit requirements.
   b) Change requests must be made in writing and signed by the Permittees in accordance with Part VI.E.
   c) Documentation of any of the actions or activities required by this Permit must be submitted to EPA upon request.
   d) EPA may review Annual Reports or other such documentation and subsequently notify the Permittees that changes to the SWMP actions and activities are necessary to:
      (i) Address discharges from the MS4 that are causing or contributing to water quality impacts;
      (ii) Include more stringent requirements necessary to comply with new federal or state statutory or regulatory requirements; or
      (iii) Include other conditions deemed necessary by EPA to comply with water quality standards, and/or other goals and requirements of the CWA.
   e) If EPA notifies the Permittees that changes are necessary pursuant to Parts II.D.2.a or II.D.2.d, the notification will offer the Permittees an opportunity to propose alternative program changes to meet the objectives of the requested modification. Following this opportunity, the Permittees must implement any required changes according to the schedule set by EPA.

4. Any modifications to this Permit will be accomplished according to Part VI.A of this Permit.

E. Transfer of Ownership, Operational Authority, or Responsibility for SWMP Implementation. The Permittees must implement the actions and activities of the SWMP in all new areas added or transferred to the Permittee's MS4 (or for which a Permittee becomes responsible for implementation of storm water quality controls) as expeditiously as practicable, but not later than one year from the date upon which the new areas were added. Such additions and schedules for implementation must be documented in the next Annual Report following the transfer.

F. SWMP Resources. The Permittees must continue to provide adequate finances, staff, equipment and other support capabilities to implement their SWMP actions and activities outlined in this permit. The Permittees must report on total costs associated with SWMP implementation over the prior 12 month reporting period in each Annual Report. Permittees are encouraged to consider establishing consistent funding sources for continued program implementation.

G. Legal Authority. To the extent allowable pursuant to the respective authority granted individual Permittees under Idaho law, each Permittee must operate to, at a minimum:

- Prohibit and eliminate, through statute, ordinance, policy, permit, contract, court or administrative order or other similar means, the contribution of pollutants to the MS4 by illicit connections and discharges to the MS4. Illicit connections include pipes, drains, open channels, or other conveyances that have the potential to allow an illicit discharge to enter the MS4. Illicit discharges include all non-storm water discharges not otherwise authorized under Part I.D. of this Permit;
- Control through statute, ordinance, policy, permit, contract, court or administrative order, or other similar means, the discharge to the MS4 of spills, dumping or disposal of materials other than storm water;
- Control through interagency agreements among the Permittees the contribution of pollutants from one portion of the MS4 to another portion of the MS4;
- Require compliance with conditions in statutes, ordinances, policy, permits, contracts, or court or administrative orders; and
- Carry out all inspection, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with Permit conditions including the prohibition on illicit discharges to the MS4.

No later than January 30, 2014, each Permittee must review and revise its relevant ordinances or other regulatory mechanisms, (or adopt new ordinances or regulatory mechanisms that provide it with adequate legal authority as allowed and authorized pursuant to applicable Idaho law), to control pollutant discharges into and from its MS4 and to meet the requirements of this permit. As part of the SWMP documentation that accompanies the 1st Year Annual Report, each Permittee must summarize all of its unique legal authorities which satisfy the five criteria listed above.

III. Schedule for Implementation and Required Submissions

The Permittees must complete SWMP actions, and/or submit documentation, to EPA and IDEQ as summarized below. Unless otherwise noted, Annual Reports must include the interim or completed status of required SWMP activities occurring during the corresponding reporting period as specified in Part IV.C.3, and include program summary statistics, copies of interim or final documents, and/or other supporting information.

Table III. Schedule for Implementation and Required Submissions

Permit Part	Item/Action	Due Date
I.C.3	Update intergovernmental agreement no later than July 1, 2013.	Submit updated intergovernmental agreement with the 1st Year Annual Report.
II.A.1.b, II.C.3	SWMP documentation	Submit SWMP documentation with the 1st Year Annual Report. Include updated documentation in each subsequent Annual Report.
II.A.4	Complete two subwatershed planning documents	Identify subwatersheds in 1st Year Annual Report; Submit two completed planning documents with the 4rd Year Annual Report.
II.B.1.a	Update construction runoff control ordinances/ regulatory mechanisms, if necessary	September 30, 2015; submit any updated ordinances etc w/ 3rd Year Annual Report.
II.B.1.b	Update Construction Stormwater Management Manual(s)	September 30, 2015; submit any updated documents with 3rd Year Annual Report.
II.B.1.e	Develop & Implement Enforcement Response Policy (ERP)	September 30, 2016; submit final ERPs w/ 4th Year Annual Report
II.B.2.a	Update ordinance or regulatory mechanism requiring long term onsite stormwater management controls	January 30, 2018; submit ordinance or regulatory mechanism with 5th Year Annual Report.
II.B.2.b	Update Stormwater Design Criteria Manual(s)	September 30, 2015; submit any updated ordinances etc w/ 3rd Year Annual Report
II.B.2.c	Develop & Implement Green Infrastructure/Low Impact Development (LID) Incentive Strategy;	September 30, 2015;
II.B.2.c.i	Evaluate Effectiveness of LID Practices via three Pilot Projects;	Submit strategy document, identify 3 pilot projects in the 3rd Year Annual Report.
II.B.2.c.ii, IV.A.10	Identify recommendations for specific LID practices to be adopted within the Permit area	Progress report on strategy implementation/ Pilot Project evaluations w/4rd Year Annual Report. Submit final evaluations & recommendations with the 5th Year Annual Report.
II.B.2.c.iii	Develop Priority Riparian Area List	September 30, 2015; Submit priority area list with the 3rd Year Annual Report.
II.B.2.c.iii	Complete Outfall Disconnection Project	Document progress on outfall disconnection project w/3rd Year Annual Report. Complete outfall disconnection project by January 30, 2018; document completed project in 5th Year Annual Report.

Table III. Schedule for Implementation and Required Submissions, continued

Permit Part	Item/Action	Due Date
II.B.2.c.iv	Consider/install stormwater runoff reduction techniques for streets, roads & parking lot repair work entering design phase after February 1, 2013 where feasible	Document all locations of street/road/parking lot repair projects where runoff reduction techniques were installed w/5th Year Annual Report.
II.B.2.e.i	O&M Database of new permanent stormwater controls; Incorporate all existing controls into database	Include new controls beginning February 1, 2013; Existing controls, no later than January 30, 2018.
II.B.2.f.i	Identify high priority locations; annual inspections	September 30, 2017
II.B.2.f.ii	Develop inspection checklists	September 30, 2017
II.B.2.f.iii	Enforcement Response Policy for SW controls	September 30, 2017
II.B.2.g	Conduct Education/Training on Permanent SW Controls	September 30, 2015; staff training & training for local audiences, September 30, 2016.
II.B.3.a	Inventory Industrial & Commercial facilities/activities	September 30, 2016
II.B.3.a.iii	Identify two specific activities, develop BMPs, and begin compliance assistance education program	September 30, 2016
II.B.3.b	Update Permittee agreements; inspect selected industrial & commercial facilities/activities	September 30, 2016
II.B.3.c	Document industrial & commercial inspection and compliance assistance activities	Annually
II.B.4.a	Update MS4 system inventory & map	No later than January 30, 2018; include w/5th Year Annual Report
II.B.4.b	Inspect of catch basins at least every two years	September 30, 2016
II.B.4.c	Update SOPs for Street & Road Maintenance	September 30, 2015
II.B.4.c.iii	Cover storage facilities for sand/salt storage areas	September 30, 2017; Identify locations in SWMP w/1st year Annual Report; Final documentation w/5th Year Annual Report
II.B.4.d	Update Street/Road/Parking Lot Sweeping Plans	September 30, 2015
II.B.4.d.i	Inventory/map designated areas	September 30, 2014; submit w/2st Year Annual Report
II.B.4.d.ii	Sweep according to schedule	September 30, 2015
II.B.4.d.iv,	Identify infeasible sweeping areas, alternative schedule or other program	Document in 1st Year Annual Report
II.B.4.d.v	Estimate sweeping effectiveness	Document in each Annual Report
II.B.4.f	Develop facility& maintenance yards SWPPPs	September 30, 2015
II.B.4.i	Train Permittee staff	September 30, 2016; annually thereafter
II.B.4.g	Evaluate the feasibility of retrofitting existing control devices	January 30, 2018; submit evaluation with 5th Year Annual Report

Table III. Schedule for Implementation and Required Submissions, continued

Permit Part	Item/Action	Due Date
II.B.5.c	Inventory/Map Illicit Discharge Reports	September 30, 2014, update annually
II.B.5.d.ii, IV.A.11	Conduct dry weather outfall screening; update screening plan; inspect 20% of outfalls per year	September 30, 2015; inspect 20% annual ly
II.B.6.b	Conduct public education & assess understanding to specific audiences	September 30, 2014; ongoing
II.B.6.d	Maintain, Promote, and Update Storm water Website	September 30, 2014, quarterly thereafter
II.C.3, II.A.1.b	Identify how Permittee controls are implemented to reduce discharge of pollutants of concern, measure SWMP effectiveness	Include discussion in SWMP documentation submitted with 1st Year Annual Report
II.E	Implement SWMP in all geographic areas newly added or annexed by Permittee	No later than one year from date new areas are added to Permittee's jurisdiction
II.F	Report SWMP implementation costs for the corresponding 12 month reporting period	Within each Annual Report
II.G	Review & Summarize legal authorities or regulatory mechanisms used by Permittee to implement & enforce SWMP & Permit requirements	No later than January 30, 2014, summarize legal authorities within the required SWMP documentation submitted with 1st Annual Report
IV.A.1	Assess & Document Permit Compliance	Annually; submit with Annual Reports
IV.A.2	Develop & Complete Stormwater Monitoring & Evaluation Plan	September 30, 2014; Submit Completed Plan with 2nd Year Annual Report
IV.A.7.a	Update *Boise NPDES Municipal SW Monitoring Plan*	September 30, 2015
IV.A.7.b	Monitor Five Representative Outfalls During Wet Weather; sample three times per year thereafter	No later than September 30, 2014
IV.A.8	If Applicable: update SW Monitoring & Evaluation Plan to include WQ Monitoring and/or Fish Tissue Sampling	If applicable: Update SW Monitoring & Evaluation Plan by September 30, 2014 to include WQ Monitoring and/or Fish Tissue Sampling; submit with 2nd Year Annual Report
IV.A.9	Evaluate Effectiveness of 2 Structural Control Techniques Currently Required by the Permittees	Begin evaluations no later than September 30, 2015; document in Annual Report(s)
IV.C.1	Submit Stormwater Outfall Discharge Data	2nd Year Annual Report, annually thereafter
IV.C.2	Submit WQ Monitoring or Fish Tissue Sampling Data Report (if applicable)	2nd Year Annual Report, annually thereafter
IV.C.3	Submit Annual Reports	1st Year Annual Report due January 30, 2014; all subsequent Annual Reports are due annually no later than January 30th; See Table IV.C.
VI.B	Submit Permit Renewal Application	No later than 180 days prior to Permit Expiration Date; see cover page. Alternatively, Renewal Application may be submitted as part of the 4th Year Annual Report.

IV. Monitoring, Recordkeeping and Reporting Requirements.

A. Monitoring

1. **Assess Permit Compliance.** At least once per year, each Permittee must individually evaluate their respective organization's compliance with these Permit conditions, and progress toward implementing each of the control measures defined in Part II. The compliance evaluation must be documented in each Annual Report required in Part IV.C.2.

2. **Stormwater Monitoring and Evaluation Program Plan and Objectives.** The Permittees must conduct a wet weather monitoring and evaluation program, or contract with another entity to implement such a program. This stormwater monitoring and evaluation program must be designed to characterize the quality of storm water discharges from the MS4, and to evaluate overall effectiveness of selected storm water management practices.

   a) No later than September 30, 2014, the Permittees must develop a stormwater monitoring and evaluation plan that includes the quality assurance requirements, outfall monitoring, in-stream and/or fish tissue monitoring (as appropriate), evaluation of permanent storm water controls and evaluation of LID pilot project effectiveness as described later in this Part. In general, the Permittees must develop and conduct a stormwater monitoring and evaluation program to:

      (i) Broadly estimate reductions in annual pollutant loads of sediment, bacteria, phosphorus and temperature discharged to impaired receiving waters from the MS4s, occurring as a result of the implementation of SWMP activities;

      (ii) Assess the effectiveness and adequacy of the permanent storm water controls and LID techniques or controls selected for evaluation by the Permittees and which are intended to reduce the total volume of storm water discharging from impervious surfaces and/or improve overall pollutant reduction in stormwater discharges; and

      (iii) Identify and prioritize those portions of each Permittee's MS4 where additional controls can be accomplished to further reduce total volume of storm water discharged and/or reduce pollutants in storm water discharges to waters of the U.S.

   b) The final, updated stormwater monitoring and evaluation plan must be submitted to EPA with the 2nd Year Annual Report.

3. **Representative Sampling.** Samples and measurements must be representative of the nature of the monitored discharge or activity**.**

4. **Analytical Methods.** Sample collection, preservation, and analysis must be conducted according to sufficiently sensitive methods/test procedures approved under 40 CFR Part 136, unless otherwise approved by EPA. Where an approved 40 CFR Part 136 method does not exist, and other test procedures

have not been specified, any available method may be used after approval from EPA**.**

5. **Quality Assurance Requirements.** The Permittees must develop or update a quality assurance plan (QAP) for all analytical monitoring conducted in accordance with this Part. The QAP must be developed concurrently as part of the stormwater monitoring and evaluation plan. The Permittees must submit the QAP as part of the stormwater monitoring and evaluation plan to EPA and IDEQ in the 2nd Year Annual Report. Any existing QAP may be modified for the requirements under this section**.**

   a) The QAP must be designed to assist in the collection and analysis of storm water discharges in support of this Permit and in explaining data anomalies when they occur.

   b) Throughout all sample collection, analysis and evaluation activities, Permittees must use the EPA-approved QA/QC and chain-of-custody procedures described in the most current version of the following documents:

      (i) *EPA Requirements for Quality Assurance Project Plans EPA-QA/R-5* (EPA/240/B-01/003, March 2001). A copy of this document can be found electronically at: http://www.epa.gov/quality/qs-docs/r5-final.pdf;

      (ii) *Guidance for Quality Assurance Project Plans EPA-QA/G-5*, (EPA/600/R-98/018, February, 1998). A copy of this document can be found electronically at: http://www.epa.gov/r10earth/offices/oea/epaqag5.pdf ;

      (iii) *Urban Storm BMP Performance Monitoring*, (EPA-821-B-02-001, April 2002). A copy of this document can be found electronically at: http://www.epa.gov/npdes/pubs/montcomplete.pdf

      The QAP should be prepared in the format specified in these documents.

   c) At a minimum, the QAP must include the following:

      (i) Organization chart reflecting responsibilities of key Permittee staff;

      (ii) Details on the number of samples, type of sample containers, preservation of samples, holding times, analytical methods, analytical detection and quantitation limits for each target compound, type and number of quality assurance field samples, precision and accuracy requirements, sample representativeness and completeness, sample preparation requirements, sample shipping methods, and laboratory data delivery requirements;

      (iii) Data quality objectives;

(iv) Map(s) and associated documentation reflecting the location of each sampling point and physical description including street address or latitude/longitude;

(v) Qualification and training of personnel;

(vi) Name(s), address(es) and telephone number(s) of the laboratories, used by or proposed to be used by the Permittees;

(vii) Data management;

(viii) Data review, validation and verification; and

(ix) Data reconciliation.

d) The Permittees must amend the QAP whenever there is a modification in sample collection, sample analysis, or other procedure addressed by the QAP. The amended QAP must be submitted to EPA as part of the next Annual Report.

e) Copies of any current QAP must be maintained by the Permittees and made available to EPA and/or IDEQ upon request.

6. **Additional Monitoring by Permittees.** If the Permittees monitor more frequently, or in more locations, than required by this Permit, the results of any such additional monitoring must be included and summarized with other data submitted to EPA and IDEQ as required in Part IV.C.

7. **Storm Water Outfall Monitoring**

a) No later than September 30, 2015, the Permittees must update the existing *Boise NPDES Municipal Storm Water Permit Monitoring Plan* to be consistent with the monitoring and evaluation program objectives and plan as described in Part IV.A.2. At a minimum, the plan must describe five outfall sample locations, and any additional or alternative locations, as defined by the Permittees. The outfalls selected by the Permittees to be monitored must be identified as representative of all major land uses occurring within the Permit area.

b) No later than September 30, 2014, the Permittees must begin monitoring discharges from the identified five storm water outfalls during wet weather events at least three times per year. The specific minimum monitoring requirements are outlined in Table IV.A, but may be augmented based on the Permittees' updated stormwater monitoring and evaluation plan required by Part IV.A.2. The Permittees must include any additional parameters to be sampled in an updated Table IV.A within the final updated stormwater monitoring and evaluation plan submitted to EPA with the 2nd Annual Report.

Table IV.A – Outfall Monitoring Requirements[1, 2]
PARAMETER SAMPLING
Ammonia
Total Kjeldahl Nitrogen (TKN) (mg/l)
Nitrate + Nitrite
Total Phosphorus (mg/l)
Dissolved Orthophosphate (mg/l)
E. coli
Biological Oxygen Demand (BOD5) (mg/l)
Chemical Oxygen Demand (COD) (mg/l)
Total Suspended Solids (TSS) (mg/l)
Total Dissolved Solids (TDS) (mg/l)
Dissolved Oxygen
Turbidity (NTU)
Temperature
pH (S.U)
Flow/Discharge, Volume, in cubic feet
Arsenic – Total
Cadmium- Total and Dissolved
Copper – Dissolved
Lead – Total and Dissolved
Mercury – Total
Zinc – Dissolved
Hardness (as CaCO3) (mg/l)

[1] Five or more outfall locations will be identified in the Permittees' updated stormwater monitoring and evaluation plan

[2] A minimum of ***three (3) samples*** must be collected during wet weather storm events in each reporting year, assuming the presence of storm events sufficient to produce a discharge.

8. **Water Quality Monitoring and/or Fish Tissue Sampling**. At the Permittees' option and to augment the storm water discharge data collection required in Part IV.A.7 above, one or more of the Permittees may conduct, or contract with others to conduct, water quality monitoring and/or fish tissue sampling within the Lower Boise River Watershed.

   a) If the Permittees elect to conduct in-stream water quality monitoring and/or fish tissue sampling within the Lower Boise River Watershed, the Permittees must revise the stormwater monitoring and evaluation plan and QAP to describe the monitoring and/or sampling effort(s) per Part IV.A.2 and IV.A.5, no later September 30, 2014.

   b) The documentation of the Permittees' intended in-stream water quality monitoring and/or fish tissue sampling activities must be included in the final updated stormwater monitoring and evaluation plan submitted with the 2nd Year Annual Report as required in Part IV.A.2.b.

   c) The Permittees are encouraged to engage in cooperative efforts with other organizations to collect reliable methylmercury fish tissue data within a specific geographic area of the Lower Boise River Watershed. The objective of the cooperative effort is to determine if fish tissue concentrations of methylmercury in the Lower Boise River are compliant with Idaho's methylmercury fish tissue criterion of 0.3 mg/kg.

      (i) In particular, the Permittees are encouraged to cooperate with other organizations to collect data through implementation of the Methylmercury Fish Tissue Sampling requirements specified in NPDES Permits # ID-002044-3 and ID-002398-1 as issued to the City of Boise. Beginning with the 2nd Year Annual Report, the Permittees' may (individually or collectively) submit documentation in each Annual Report which describes their specific involvement over the prior reporting period, and may reference fish tissue sampling plans and data reports as developed or published by others through the cooperative watershed effort.

9. **Evaluate the Effectiveness of Required Structural Controls**. Within two years of the effective date of this Permit, the Permittees must select and begin to evaluate at least two different types of permanent structural storm water management controls currently mandated by the Permittees at new development or redevelopment sites. For each selected control, this evaluation must determine whether the control is effectively treating or preventing the discharge of one or more of the pollutants of concern into waterbodies listed in Table II.C. The results of this evaluation, and any recommendations for improved treatment performance, must be submitted to EPA in subsequent Annual Reports as the evaluation projects are implemented and completed.

10. **Evaluate the Effectiveness of Green Infrastructure/Low Impact Development Pilot Projects**. The Permittees must evaluate the performance and effectiveness of the three pilot projects required in Part II.B.2.c of this Permit, or contract with another entity to conduct such evaluations. An evaluation summary of the LID technique or control and any recommendations

of improved treatment performance must be submitted in subsequent Annual Reports as the evaluation projects are implemented and completed.

11. **Dry Weather Discharge Screening.** The Permittees must implement a dry weather screening program, or contract with another entity to implement such a program, as required in Part II.B.5.d.

B. Recordkeeping

1. **Retention of Records.** The Permittees must retain records and copies of all information (e.g., all monitoring, calibration, and maintenance records; all original strip chart recordings for any continuous monitoring instrumentation; copies of all reports required by this Permit; storm water discharge monitoring reports; a copy of the NPDES permit; and records of all data or information used in the development and implementation of the SWMP and to complete the application for this Permit;) for a period of at least five years from the date of the sample, measurement, report or application, or for the term of this Permit, whichever is longer. This period may be extended at the request of the EPA at any time.
2. **Availability of Records.** The Permittees must submit the records referred to in Part IV.B.1 to EPA and IDEQ only when such information is requested. At a minimum, the Permittees must retain all records comprising the SWMP required by this Permit (including a copy of the Permit language and all Annual Reports) in a location and format that are accessible to EPA and IDEQ. The Permittees must make all records described above available to the public if requested to do so in writing. The public must be able to view the records during normal business hours. The Permittees may charge the public a reasonable fee for copying requests**.**

C. Reporting Requirements

1. **Storm Water Discharge Monitoring Report.** Beginning with the 2nd Year Annual Report, and in subsequent Annual Reports, all storm water discharge monitoring data collected to date must be submitted as part of the Annual Report. At a minimum, this Storm Water Discharge Monitoring Report must include:
   a) Dates of sample collection and analyses;
   b) Results of sample analyses;
   c) Location of sample collection. and
   d) Summary discussion and interpretation of the data collected, including a discussion of quality assurance issues and comparison to previously collected information, as appropriate.
2. **Water Quality Monitoring and/or Fish Tissue Sampling Report(s).** If the Permittees elect to conduct water quality monitoring and/or fish tissue sampling as specified in Part IV.A.8, all relevant monitoring data collected to date must

be submitted as part of each Annual Report beginning with the 2nd Year Annual Report. Summary data reports as prepared by other organizations with whom the Permittee(s) cooperate may be submitted to fulfill this requirement. At a minimum, this Water Quality Monitoring and/or Fish Tissue Sampling Report must include:

a) Dates of sample collection and analyses;

b) Results of sample analyses;

c) Locations of sample collection; and

d) Summary discussion and interpretation of the data collected, including discussion of quality assurance issues and comparison to previously collected information, as appropriate.

3. **Annual Report.**

a) No later than January 30th of each year beginning in 2014, and annually thereafter, each Permittee must submit an Annual Report to EPA and IDEQ. The reporting period for the 1st Year Annual Report will be from February 1, 2013, through September 30, 2013. Reporting periods for subsequent Annual Reports are specified in Table IV.C. Copies of all Annual Reports, including each Permittee's SWMP documentation, must be available to the public, through a Permittee-maintained website, and/or through other easily accessible means.

Table IV.C - Annual Report Deadlines

Annual Report	Reporting Period	Due Date
1st Year Annual Report	February 1, 2013–September 30, 2013	January 30, 2014
2nd Year Annual Report	October 1, 2013-September 30, 2014	January 30, 2015
3rd Year Annual Report	October 1, 2014-September 30, 2015	January 30, 2016
4th Year Annual Report	October 1, 2015-September 30, 2016	January 30, 2017
5th Year Annual Report	October 1, 2016-December 31, 2017	January 30, 2018

b) Preparation and submittal of the Annual Reports must be coordinated by Ada County Highway District. Each Permittee is responsible for content of their organization's SWMP documentation and Annual Report(s) relating to SWMP implementation for portions of the MS4s for which they are responsible.

c) The following information must be submitted in each Annual Report:

(i) A updated and current document describing the SWMP as implemented by the specific Permittee, in accordance with Part II.A.1.b;

(ii) A narrative assessment of the Permittee's compliance with this Permit, describing the status of implementing the control measures in Parts II and IV. The status of each control measure must be addressed, even if activity has previously been completed, has not yet been implemented, does not apply to the Permittee's jurisdiction or operation, or is conducted on the Permittee's behalf by another entity;

(iii) Discussion of any information collected and analyzed during the reporting period, including but not limited to storm water monitoring data not included with the Storm Water Discharge Monitoring Report; dry weather monitoring results; Green Infrastructure/LID pilot project evaluation results, structural control evaluation results, and any other information collected or used by the Permittee(s) to assess the success of the SWMP controls at improving receiving water quality to the maximum extent practicable;

(iv) A summary of the number and nature of public education programs; the number and nature of complaints received by the Permittee(s), and follow-up actions taken; and the number and nature of inspections, formal enforcement actions, or other similar activities as performed by the Permittee(s) during the reporting period;

(v) Electronic copies of new or updated education materials, ordinances (or other regulatory mechanisms), inventories, guidance materials, or other products produced as required by this Permit during the reporting period;

(vi) A description and schedule of the Permittee's implementation of additional controls or practices deemed necessary by the Permittee, based on monitoring or other information, to ensure compliance with applicable water quality standards;

(vii) Notice if the Permittee is relying on another entity to satisfy any of the Permit obligations, if applicable; and

(viii) Annual expenditures for the reporting period, and estimated budget for the reporting period following each Annual Report.

d) If, after the effective date of this Permit, EPA provides the Permittees with an alternative Annual Report format, the Permittees may use the alternative format in lieu of the required elements of Part IV.C.3.c.

D. Addresses

Reports and other documents required by this Permit must be signed in accordance with Part VI.E and submitted to each of the following addresses:

IDEQ: Idaho Department of Environmental Quality
Boise Regional Office
Attn: Water Program Manager
1410 North Hilton
Boise, ID 83854

EPA: United States Environmental Protection Agency
Attention: Storm Water MS4 Compliance Program
NPDES Compliance Unit
1200 6th Avenue, Suite 900 (OCE-133)
Seattle, WA 98101

Any documents and/or submittals requiring formal EPA approval must also be submitted to the following address:

United States Environmental Protection Agency
Attention: Storm Water MS4 Permit Program
NPDES Permits Unit
1200 6th Avenue, Suite 900 (OWW-130)
Seattle, WA 98101

V. Compliance Responsibilities.

A. Duty to Comply. The Permittees must comply with all conditions of this Permit. Any Permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, for Permit termination, revocation and reissuance, or modification, or for denial of a Permit renewal application.

B. Penalties for Violations of Permit Conditions

1. Civil and Administrative Penalties. Pursuant to 40 CFR Part 19 and the Act, any person who violates Section 301, 302, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any such sections in a permit issued under section 402 of the Act, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed the maximum amounts authorized by Section 309(d) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701) (currently $37,500 per day for each violation).

2. Administrative Penalties. Any person may be assessed an administrative penalty by the Administrator for violating Section 301, 302, 306, 307, 308, 318 or 405 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under Section 402 of this Act. Pursuant to 40 CFR Part 19

and the Act, administrative penalties for Class I violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(A) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701) (currently $16,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $37,500). Pursuant to 40 CFR Part 19 and the Act, penalties for Class II violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(B) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701) (currently $16,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $177,500).

3. Criminal Penalties

a) **Negligent Violations**. The Act provides that any person who negligently violates Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such sections in a permit issued under Section 402 of the Act, or any requirement imposed in a pretreatment program approved under Section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment of not more than one year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation, or by imprisonment of not more than two years, or both.

b) **Knowing Violations**. Any person who knowingly violates such sections, or such conditions or limitations is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than three years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than six years, or both.

c) **Knowing Endangerment**. Any person who knowingly violates Section 301, 302, 303, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in Section 309(c)(3)(B)(iii) of the Act, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than $1,000,000 and can be fined up to $2,000,000 for second or subsequent convictions.

d) **False Statements.** The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this Permit shall, upon conviction, be

punished by a fine of not more than $10,000, or by imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both. The Act further provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this Permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for the Permittees in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with this Permit.

D. Duty to Mitigate. The Permittees must take all reasonable steps to minimize or prevent any discharge or disposal in violation of this Permit that has a reasonable likelihood of adversely affecting human health or the environment**.**

E. Proper Operation and Maintenance. The Permittees must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this Permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the Permittees only when the operation is necessary to achieve compliance with the conditions of the Permit.

F. Toxic Pollutants. The Permittees must comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the Permit has not yet been modified to incorporate the requirement.

G. Planned Changes. The Permittee(s) must give notice to the Director and IDEQ as soon as possible of any planned physical alterations or additions to the permitted facility whenever:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR §122.29(b); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in the Permit.

H. Anticipated Noncompliance. The Permittee(s) must give advance notice to the Director and IDEQ of any planned changes in the permitted facility or activity that may result in noncompliance with this Permit.

I. Twenty-four Hour Notice of Noncompliance Reporting

1. The Permittee(s) must report the following occurrences of noncompliance by telephone within 24 hours from the time the Permittee(s) becomes aware of the circumstances:

a) any noncompliance that may endanger health or the environment;

b) any unanticipated bypass that exceeds any effluent limitation in the permit (See Part IV.F., "Bypass of Treatment Facilities");

c) any upset that exceeds any effluent limitation in the permit (See Part IV.G., "Upset Conditions"); or

d) any overflow prior to the stormwater treatment facility over which the Permittee(s) has ownership or has operational control. An overflow is any spill, release or diversion of municipal sewage including:

(1) an overflow that results in a discharge to waters of the United States; and

(2) an overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral) that does not reach waters of the United States.

2. The Permittee(s) must also provide a written submission within five days of the time that the Permittee(s) becomes aware of any event required to be reported under subpart 1 above. The written submission must contain:

a) a description of the noncompliance and its cause;

b) the period of noncompliance, including exact dates and times;

c) the estimated time noncompliance is expected to continue if it has not been corrected; and

d) steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

e) if the noncompliance involves an overflow, the written submission must contain:

(1) The location of the overflow;

(2) The receiving water (if there is one);

(3) An estimate of the volume of the overflow;

(4) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe);

(5) The estimated date and time when the overflow began and stopped or will be stopped;

(6) The cause or suspected cause of the overflow;

(7) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;

(8) An estimate of the number of persons who came into contact with wastewater from the overflow; and

(9) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps.

3. The Director of the Office of Compliance and Enforcement may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the NPDES Compliance Hotline in Seattle, Washington, by telephone, (206) 553-1846.

4. Reports must be submitted to the addresses in Part IV.D ("Addresses").

J. Bypass of Treatment Facilities

1. Bypass not exceeding limitations. The Permittee(s) may allow any bypass to occur that does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this Part.

2. Notice.

a) **Anticipated bypass**. If the Permittee(s) knows in advance of the need for a bypass, it must submit prior written notice, if possible at least 10 days before the date of the bypass.

b) **Unanticipated bypass.** The Permittee(s) must submit notice of an unanticipated bypass as required under Part III.G ("Twenty-four Hour Notice of Noncompliance Reporting").

3. Prohibition of bypass.

a) Bypass is prohibited, and the Director of the Office of Compliance and Enforcement may take enforcement action against the Permittee(s) for a bypass, unless:

(1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The Permittee(s) submitted notices as required under paragraph 2 of this Part.

b) The Director of the Office of Compliance and Enforcement may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph 3.a. of this Part.

K. Upset Conditions

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the Permittee(s) meets the requirements of paragraph 2 of this Part. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. Conditions necessary for a demonstration of upset. To establish the affirmative defense of upset, the Permittee(s) must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

a) An upset occurred and that the Permittee(s) can identify the cause(s) of the upset;

b) The permitted facility was at the time being properly operated;

c) The Permittee(s) submitted notice of the upset as required under Part V.I, "*Twenty-four Hour Notice of Noncompliance Reporting;*" and

d) The Permittee(s) complied with any remedial measures required under Part V.D, "*Duty to Mitigate.*"

3. Burden of proof. In any enforcement proceeding, the Permittee(s) seeking to establish the occurrence of an upset has the burden of proof.

VI. General Provisions

A. Permit Actions.

1. This Permit may be modified, revoked and reissued, or terminated for cause as specified in 40 CFR **§§** 122.62, 122.64, or 124.5. The filing of a request by the Permittee(s) for a Permit modification, revocation and reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any Permit condition.

2. Permit coverage may be terminated, in accordance with the provisions of 40 CFR §§122.64 and 124.5, for a single Permittee without terminating coverage for the other Permittees subject to this Permit.

B. Duty to Reapply. If the Permittees intend to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittees must apply for and obtain a

new permit. In accordance with 40 CFR §122.21(d), and unless permission for the application to be submitted at a later date has been granted by the Director, the Permittees must submit a new application at least 180 days before the expiration date of this Permit, or alternatively in conjunction with the 4th Year Annual Report. The reapplication package must contain the information required by 40 CFR §122.21(f), which includes: name and mailing address(es) of the Permittees(s) that operate the MS4(s), and names and titles of the primary administrative and technical contacts for the municipal Permittees(s). In addition, the Permittees must identify any previously unidentified water bodies that receive discharges from the MS4(s); a summary of any known water quality impacts on the newly identified receiving waters; a description of any changes to the number of applicants; and any changes or modifications to the Storm Water Management Program as implemented by the Permittees. The re-application package may incorporate by reference the 4th Year Annual Report when the reapplication requirements have been addressed within that report.

C. Duty to Provide Information. The Permittees must furnish to the Director and IDEQ, within the time specified in the request, any information that the Director or IDEQ may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittees must also furnish to the Director or IDEQ, upon request, copies of records required to be kept by this Permit.

D. Other Information. When the Permittees become aware that it failed to submit any relevant facts in a Permit application, or that it submitted incorrect information in a Permit application or any report to the Director or IDEQ, the Permittees must promptly submit the omitted facts or corrected information.

E. Signatory Requirements. All applications, reports or information submitted to the Director and IDEQ must be signed and certified as follows.

1. All Permit applications must be signed as follows:
   a) For a corporation: by a responsible corporate officer.
   b) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
   c) For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the Permit and other information requested by the Director or the IDEQ must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
   a) The authorization is made in writing by a person described above;
   b) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or

position having overall responsibility for environmental matters for the organization; and

c) The written authorization is submitted to the Director and IDEQ.

3. **Changes to Authorization.** If an authorization under Part VI.E.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part VI.E.2 must be submitted to the Director and IDEQ prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this Part must make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

F. Availability of Reports. In accordance with 40 CFR Part 2, information submitted to EPA pursuant to this Permit may be claimed as confidential by the Permittees. In accordance with the Act, permit applications, permits and effluent data are not considered confidential. Any confidentiality claim must be asserted at the time of submission by stamping the words “confidential business information” on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice to the Permittees. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2, Subpart B (Public Information) and 41 Fed. Reg. 36902 through 36924 (September 1, 1976), as amended.

G. Inspection and Entry. The Permittees must allow the Director, IDEQ, or an authorized representative (including an authorized contractor acting as a representative of the Director), upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the Permittees' premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring Permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

H. Property Rights. The issuance of this Permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to persons or property or invasion of other private rights, nor any infringement of state or local laws or regulations.

I. Transfers. This Permit is not transferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the Permit to change the name of the Permittees and incorporate such other requirements as may be necessary under the Act. (See 40 CFR 122.61; in some cases, modification or revocation and reissuance is mandatory.)

J. State/Tribal Environmental Laws

1. Nothing in this Permit shall be construed to preclude the institution of any legal action or relieve the Permittees from any responsibilities, liabilities, or penalties established pursuant to any applicable State/Tribal law or regulation under authority preserved by Section 510 of the Act**.**
2. No condition of this Permit releases the Permittees from any responsibility or requirements under other environmental statutes or regulations.

K. Oil and Hazardous Substance Liability Nothing in this Permit shall be constructed to preclude the institution of any legal action or relieve the Permittees from any responsibilities, liabilities, or penalties to which the Permittees is or may be subject under Section 311 of the CWA or Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

L. Severability The provisions of this Permit are severable, and if any provision of this permit, or the application of any provision of this Permit to any circumstance, is held invalid, the application of such provision to the circumstances, and the remainder of this Permit shall not be affected thereby.

VII. Definitions and Acronyms

All definitions contained in Section 502 of the Act and 40 CFR Part 122 apply to this Permit and are incorporated herein by reference. For convenience, simplified explanations of some regulatory/statutory definitions have been provided but, in the event of a conflict, the definition found in the statute or regulation takes precedence.

“Administrator” means the Administrator of the EPA, or an authorized representative.

“Animal facility” see “commercial animal facility.”

“Annual Report” means the periodic self –assessment submitted by the Permittee(s) to document incremental progress towards meeting the storm water management requirements and implementation schedules as required by this Permit. See Part IV.C.

"Best Management Practices (BMPs)" means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. See 40 CFR § 122.2. BMP refers to operational activities, physical controls or educational measures that are applied to reduce the discharge of pollutants and minimize potential impacts upon receiving waters, and accordingly, refers to both structural and nonstructural practices that have direct impacts on the release, transport, or discharge of pollutants. See also "storm water control measure (SCM)."

"Bioretention" is the water quality and water quantity storm water management practice using the chemical, biological and physical properties of plants, microbes and soils for the removal of pollution from storm water runoff.

"Canopy Interception**"** is the interception of precipitation, by leaves and branches of trees and vegetation that does not reach the soil.

"CGP" and "Construction General Permit" means the current available version of EPA's *NPDES General Permit for Storm Water Discharges for Construction Activities in Idaho*, Permit No. IDR12-0000. EPA's CGP is posted on EPA's website at *www.epa.gov/npdes/stormwater/cgp*.

"Commercial Animal Facility" as used in this Permit, means a business that boards, breeds, or grooms animals including but not limited to dogs, cats, rabbits or horses.

"Common Plan of Development**"** is a contiguous construction project or projects where multiple separate and distinct construction activities may be taking place at different times on different schedules but under one plan. The "plan" is broadly defined as any announcement or piece of documentation or physical demarcation indicating construction activities may occur on a specific plot; included in this definition are most subdivisions and industrial parks.

"Construction activity" includes, but is not limited to, clearing, grading, excavation, and other site preparation work related to the construction of residential buildings and non-residential buildings, and heavy construction (e.g., highways, streets, bridges, tunnels, pipelines, transmission lines and industrial non-building structures).

"Control Measure" as used in this Permit, refers to any action, activity, Best Management Practice or other method used to prevent or reduce the discharge of pollutants in stormwater to waters of the United States.

"CWA" or "The Act" means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub.L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483 and Pub. L. 97-117, 33 U.S.C. 1251 et seq.

"Director" means the Environmental Protection Agency Regional Administrator, the EPA Director of the Office of Water and Watersheds, or an authorized representative.

"Discharge" when used without a qualifier, refers to "discharge of a pollutant" as defined at 40 CFR §122.2.

"Discharge of a pollutant" means (a) any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source," or (b) any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. This definition includes additions of pollutants into waters of the United States from: surface runoff which is collected or channelled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. This term does not include an addition of pollutants by any "indirect discharger."

"Discharge of Storm Water Associated with Construction Activity" as used in this Permit, refers to a discharge of pollutants in storm water runoff from areas where soil disturbing activities (*e.g.*, clearing, grading, or excavation), construction materials or equipment storage or maintenance (*e.g.*, fill piles, borrow areas, concrete truck washout, fueling) or other industrial storm water directly related to the construction process are located, and which are required to be managed under an NPDES permit. See the regulatory definitions of storm water discharge associated with large and small construction activity at 40 CFR §122.26(b)(14)(x) and 40 CFR §122.26(b)(15), respectively

"Discharge of Storm Water Associated with Industrial Activity" as used in this Permit, refers to the discharge from any conveyance that is used for collecting and conveying storm water and that is directly related to manufacturing, processing or raw materials storage areas at an industrial plant included in the regulatory definition of storm water discharge associated with industrial activity at 40 CFR §122.26(b)(14).

"Discharge-related Activities" include: activities which cause, contribute to, or result in storm water point source pollutant discharges and measures to control storm water discharges, including the siting, construction, and operation of best management practices to control, reduce or prevent storm water pollution.

"Disconnect" for the purposes of this permit, means the change from a direct discharge into receiving waters to one in which the discharged water flows across a vegetated surface, through a constructed water or wetlands feature, through a vegetated swale, or other attenuation or infiltration device before reaching the receiving water.

"Engineered Infiltration" is an underground device or system designed to accept storm water and slowly exfiltrates it into the underlying soil. This device or system is designed based on soil tests that define the infiltration rate.

"Erosion" means the process of carrying away soil particles by the action of water.

"Evaporation" means rainfall that is changed or converted into a vapor.

"Evapotranspiration" means the sum of evaporation and transpiration of water from the earth's surface to the atmosphere. It includes evaporation of liquid or solid water plus the transpiration from plants.

"Extended Filtration" is a structural storm water device which filters storm water runoff through a soil media and collects it in an underdrain which slowly releases it after the storm is over.

"EPA" means the Environmental Protection Agency Regional Administrator, the EPA Director of the Office of Water and Watersheds, or an authorized representative.

"Entity" means a governmental body, or a public or private organization.

"Existing Permanent Controls," in the context of this Permit, means post- construction or permanent storm water management controls designed to treat or control runoff on a permanent basis and that were installed prior to the effective date of this Permit.

"Facility or Activity" generally means any NPDES "point source" or any other facility or activity (including land or appurtenances thereto) that is subject to regulation under the NPDES program.

"Fish Tissue Sampling" see "Methylmercury Fish Tissue Sampling"

"Green infrastructure" means runoff management approaches and technologies that utilize, enhance and/or mimic the natural hydrologic cycle processes of infiltration, evapotranspiration and reuse.

"Hydromodification" means changes to the storm water runoff characteristics of a watershed caused by changes in land use.

"IDEQ" means the Idaho Department of Environmental Quality or its authorized representative.

"Illicit Connection" means any man-made conveyance connecting an illicit discharge directly to a municipal separate storm sewer.

"Illicit Discharge" is defined at 40 CFR §122.26(b)(2) and means any discharge to a municipal separate storm sewer that is not entirely composed of storm water, except discharges authorized under an NPDES permit (other than the NPDES Permit for discharges from the MS4) and discharges resulting from fire fighting activities.

"Impaired Water**"** (or "Water Quality Impaired Water") for purposes of this Permit means any water body identified by the State of Idaho or EPA pursuant to Section 303(d) of the Clean Water Act as not meeting applicable State water quality standards. Impaired waters include both waters with approved or established Total Maximum Daily Loads (TMDLs), and those for which a TMDL has not yet been approved or established.

"Industrial Activity" as used in this Permit refers to the eleven categories of industrial activities included in the definition of discharges of "storm water associated with industrial activity" at 40 CFR §122.26(b)(14).

"Industrial Storm Water" as used in this Permit refers to storm water runoff associated with the definition of "discharges of storm water associated with industrial activity".

"Infiltration" is the process by which storm water penetrates into soil.

"Low Impact Development" or "LID" means storm water management and land development techniques, controls and strategies applied at the parcel and subdivision scale that emphasize conservation and use of on-site natural features integrated with engineered, small scale hydrologic controls to more closely mimic pre-development hydrologic functions.

"Major outfall" is defined in 40 CFR §122.26(b)(5) and in general, means a municipal storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more.

"MEP" or "maximum extent practicable," means the technology-based discharge standard for municipal separate storm sewer systems to reduce pollutants in storm water discharges that was established by Section 402(p) of the Clean Water Act, 33 U.S.C §1342(p).

"Measurable Goal" means a quantitative measure of progress in implementing a component of a storm water management program.

"Methylmercury Fish Tissue Sampling" and "Methylmercury Fish Tissue Sampling Requirements" means the IDEQ-recommended cooperative data collection effort for the Lower Boise River Watershed. In particular, Methylmercury Fish Tissue Sampling requirements are otherwise specified in NPDES Permits # ID-002044-3 and ID-002398-1, as issued by EPA to the City of Boise and available online at http://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/Current+ID1319

"Minimize" means to reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry or municipal practices.

"MS4" means "municipal separate storm sewer system," and is used to refer to either a Large, Medium, or Small Municipal Separate Storm Sewer System as defined in 40 CFR 122.26(b). The term, as used within the context of this Permit, refers to those portions of the municipal separate storm sewer systems within the corporate limits of the City of Boise and City of Garden City that are owned and/or operated by the Permittees, namely: Ada County Highway District, Boise State University, City of Boise, City of Garden City, Drainage District #3 and/or the Idaho Transportation Department District #3.

"Municipality" means a city, town, borough, county, parish, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the CWA.

"Municipal Separate Storm Sewer" is defined in 40 CFR §122.26(b) and means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to

State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the CWA that discharges to waters of the United States; (ii) Designed or used for collecting or conveying storm water; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR §122.2.

"National Pollutant Discharge Elimination System" or "NPDES" means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the CWA. The term includes an 'approved program.'

"New Permanent Controls," in the context of this Permit, means post- construction or permanent storm water management controls designed to treat or control runoff on a permanent basis that are installed after the effective date of this permit.

"Outfall" is defined at 40 CFR §122.26(b)(9) means a point source (see definition below) at the point where a municipal separate storm sewer discharges to waters of the United States, and does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels, or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States.

"Owner or operator" means the owner or operator of any "facility or activity" subject to regulation under the NPDES program.

"Permanent storm water management controls" see "post-construction storm water management controls."

"Permitting Authority" means the U.S. Environmental Protection Agency (EPA)

"Point Source" is defined at 40 CFR §122.2 and means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

"Pollutant" is defined at 40 CFR §122.2. A partial listing from this definition includes: dredged spoil, solid waste, sewage, garbage, sewage sludge, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial or municipal waste.

"Pollutant(s) of concern" includes any pollutant identified by IDEQ as a cause of impairment of any water body that will receive a discharge from a MS4 authorized under this Permit. See Table II.C.

"Post- construction storm water management controls" or "permanent storm water management controls" means those controls designed to treat or control runoff on a permanent basis once construction is complete. See also "new permanent controls" and "existing permanent controls."

"QA/QC" means quality assurance/quality control.

"QAP" means Quality Assurance Plan.

"Rainfall and Rainwater Harvesting**"** is the collection, conveyance, and storage of rainwater. The scope, method, technologies, system complexity, purpose, and end uses vary from rain barrels for garden irrigation in urban areas, to large-scale collection of rainwater for all domestic uses.

"Redevelopment" for the purposes of this Permit, means the alteration, renewal or restoration of any developed land or property that results in land disturbance of 5,000 square feet or more, and that has one of the following characteristics: land that currently has an existing structure, such as buildings or houses; or land that is currently covered with an impervious surface, such as a parking lot or roof; or land that is currently degraded and is covered with sand, gravel, stones, or other non-vegetative covering.

"Regional Administrator" means the Regional Administrator of Region 10 of the EPA, or the authorized representative of the Regional Administrator.

"Repair of Public Streets, Roads and Parking Lots" means repair work on Permittee-owned or Permittee-managed streets and parking lots that involves land disturbance, including asphalt removal or regrading of 5,000 square feet or more. This definition excludes the following activities: pot hole and square cut patching; overlaying existing asphalt or concrete pacing with asphalt or concrete without expanding the area of coverage; shoulder grading; reshaping or regrading drainage ditches; crack or chip sealing; and vegetative maintenance.

"Runoff Reduction Techniques" means the collective assortment of storm water practices that reduce the volume of storm water from discharging off site.

"Storm Sewershed" means, for the purposes of this Permit, all the land area that is drained by a network of municipal separate storm sewer system conveyances to a single point of discharge into a water of the United States.

"Significant contributors of pollutants" means any discharge that causes or could cause or contribute to a violation of surface water quality standards.

"Small Construction Activity" – is defined at 40 CFR §122.26(b)(15) and incorporated here by reference. A small construction activity includes clearing, grading, and excavating resulting in a land disturbance that will disturb equal to or greater than one (1) acre and less than five (5) acres of land or will disturb less than one (1) acre of total land area but is part of a larger common plan of development or sale that will ultimately disturb equal to or greater than one (1) acre and less than five (5) acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the site.
"Snow management" means the plowing, relocation and collection of snow.

"Soil amendments" are components added to in situ or native soils to increase the spacing between soil particles so that the soil can absorb and hold more moisture. The amendment of soils changes

various other physical, chemical and biological characteristics so that the soils become more effective in maintaining water quality.

"Source control" storm water management means practices that control storm water *before* pollutants have been introduced into storm water

"Storm event" or "measurable storm event" for the purposes of this Permit means a precipitation event that results in an actual discharge from the outfall and which follows the preceding measurable storm event by at least 48 hours (2 days).

"Storm water" and "storm water runoff" as used in this Permit means storm water runoff, snow melt runoff, and surface runoff and drainage, and is defined at 40 CFR §122.26(b)(13). "Storm water" means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels, or pipes into a defined surface water channel or a constructed infiltration facility.

"Storm Water Control Measure" (SCM) or "storm water control device," means physical, structural, and/or managerial measures that, when used singly or in combination, reduce the downstream quality and quantity impacts of storm water. Also, SCM means a permit condition used in place of or in conjunction with effluent limitations to prevent or control the discharge of pollutants. This may include a schedule of activities, prohibition of practices, maintenance procedures, or other management practices. SCMs may include, but are not limited to, treatment requirements; operating procedures; practices to control plant site runoff, spillage, leaks, sludge, or waste disposal; or drainage from raw material storage. See "best management practices (BMPs)."

"Storm Water Facility" means a constructed component of a storm water drainage system, designed or constructed to perform a particular function or multiple functions. Storm water facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention basins, retention basins, constructed wetlands, infiltration devices, catch basins, oil/water separators, sediment basins, and modular pavement.

"Storm Water Management Practice**"** or "Storm Water Management Control" means practices that manage storm water, including structural and vegetative components of a storm water system.

"Storm Water Management Project" means a project that takes into account the effects on the water quality of the receiving waters and whether a structural storm water control device can be retrofitted to control water quality.

"Storm Water Management Program (SWMP)" refers to a comprehensive program to manage the quality of storm water discharged from the municipal separate storm sewer system. For the purposes of this Permit, the SWMP consists of the actions and activities conducted by the Permittees as required by this Permit and described in the Permittees' SWMP documentation. A "SWMP document" is the written summary describing the unique and/or cooperative means by which an individual Permittee or entity implements the specific storm water management controls Permittee within their jurisdiction.

"Storm Water Pollution Prevention Plan (SWPPP)" means a site specific plan designed to describe the control of soil, raw materials, or other substances to prevent pollutants in storm water runoff; a SWPPP is generally developed for a construction site, or an industrial facility. For the purposes of this permit, a SWPPP means a written document that identifies potential sources of pollution, describes practices to reduce pollutants in storm water discharges from the site, and identifies procedures or controls that the operator will implement to reduce impacts to water quality and comply with applicable Permit requirements.

"Structural flood control device" means a device designed and installed for the purpose of storm drainage during storm events.

"Subwatershed" for the purposes of this Permit means a smaller geographic section of a larger watershed unit with a drainage area between 2 to 15 square miles and whose boundaries include all the land area draining to a point where two second order streams combine to form a third order stream. A subwatershed may be located entirely within the same political jurisdiction.

"TMDL" means Total Maximum Daily Load, an analysis of pollutant loading to a body of water detailing the sum of the individual waste load allocations for point sources and load allocations for non-point sources and natural background. See 40 CFR §130.2.

"Treatment control" storm water management means practices that 'treat' storm water after pollutants have been incorporated into the storm water.

"Urban Agriculture" and "Urban Agricultural Activities" means the growing, processing, and distribution of food and other products through intensive plant cultivation and animal husbandry in and around cities. For the purposes of this Permit, the term includes activities allowed and/or acknowledged by the Permittees through a local comprehensive plan ordinance, or other regulatory mechanism. For example, see: *Blueprint Boise* online at *http://www.cityofboise.org/BluePrintBoise/pdf/Blueprint%20Boise/0_Blueprint_All.pdf*, and/or *City of Boise Urban Agriculture ordinance amendment, ZOA11-00006.*

"Waters of the United States," as defined in 40 CFR 122.2, means:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All interstate waters, including interstate "wetlands";

3. All other waters such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

a. Which are or could be used by interstate or foreign travelers for recreational or other purposes;
b. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

c. Which are used or could be used for industrial purposes by industries in interstate commerce;

4. All impoundments of waters otherwise defined as waters of the United States under this definition;

5. Tributaries of waters identified in paragraphs 1 through 4 of this definition;

6. The territorial sea; and

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs 1 through 6 of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA (other than cooling ponds for steam electric generation stations per 40 CFR Part 423) which also meet the criteria of this definition are not waters of the United States. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

“Watershed” is defined as all the land area that is drained by a waterbody and its tributaries.

“Wetlands” means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Appendix B: City of Boise QAP for In-stream Water Quality Monitoring

QUALITY ASSURANCE PLAN (QAP) FOR NPDES PERMIT COMPLIANCE



CITY OF BOISE, PUBLIC WORKS DEPARTMENT,
ENVIRONMENTAL DIVISION,
SAMPLING AND MONITORING GROUP

Revision 0
05/29/2013

A1. Title and Approval Sheet

Quality Assurance Plan (QAP) for NPDES Permit Compliance

Revision 0
05/29/2013

_____ Date:_____
Kate Harris, Sampling and Monitoring Coordinator

_____ Date:_____
Robbin Finch, Water Quality Manager

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A3. Distribution List

City of Boise Public Works Department

a. Environmental Division

i. Paul Woods, Environmental Manager
ii. Robbin Finch, Water Quality Manager
iii. Kate Harris, Water Quality Sampling and Monitoring Coordinator
iv. Bryan DuFosse, WQ Senior Environmental Specialist
v. Paul Faulkner, WQ Senior Environmental Specialist
vi. David Johanek, WQ Environmental Technician

b. Operations Division

i. Marcia Schmelzer, Operations Manager
ii. Janet Finegan-Kelly, Water Quality Laboratory Manager
iii. Leslea Basterrechea, Laboratory QA/QC Coordinator
iv. Karen Griffin, Laboratory QA/QC Coordinator

A3a. Abbreviations

ACS	American Chemical Society
ASAP	As Soon as Possible
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
COC	Chain of Custody
DMR	Discharge Monitoring Report
DQO	Data Quality Objective
EFF	Effluent
EPA	Environmental Protection Agency
FBEM	Field blank on “Clean” Metals sampler
ICV	Initial Calibration Verification
IDL	Instrument Detection Level
IML	Interim Minimum Level
INF	Influent
LCS	Laboratory Control Standard
LIMS	Laboratory Information Management System
LS	Boise City’s Lander Street Treatment Facility
MDL	Method Detection Level
ML	Minimum Level
NIST	National Institute for Standards and Technology
NOx	Nitrate+nitrite
NPDES	National Pollutant Discharge Elimination System
OJT	On-the-job Training

QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
QMP	Quality Management Plan
RPD	Relative Percent Difference
SAM	Sampling and Monitoring
SOP	Standard Operating Procedure
WB	Boise City's West Boise Treatment Facility

A4. Project/Task Organization

Boise City's Public Works Department owns and operates two secondary treatment facilities permitted under EPA's NPDES program. The Lander Street Wastewater Treatment Facility, located at 790 Lander St. Boise, Idaho, 83703 (Ph. 208/608-7380); and the West Boise Wastewater Treatment Facility located at 11818 Joplin Road, Boise, Idaho, 83714(Ph. 208/608-7240). The Water Quality Sampling and Monitoring (SAM) Group will be teaming with the City of Boise Water Quality Laboratory, located at 11818 Joplin Rd Boise, Idaho 83714(Ph. 208/608-7240) to meet the compliance monitoring requirements in NPDES wastewater permits: ID002044-3 and ID0022398-1.

The responsibilities of the Water Quality SAM group as outlined in this plan will be to collect and deliver accurate monitoring data and compliance samples for testing to the City of Boise Water Quality Laboratory as needed for completion of the monthly Discharge Monitoring Reports; perform testing and sampling using EPA approved methods and properly calibrated test equipment; hold all original documentation on-site for a minimum of 5 years.

The responsibilities of the Water Quality Laboratory will be to prepare sampling containers; receive, split and store samples; document laboratory and field laboratory analytical procedures in standard operating procedures (SOPs); analyze samples for specified parameters using methods approved for NPDES compliance; send samples to a contract laboratory if no in-house capabilities exist; alert Operations staff of permit violations; alert SAM group if resampling is needed; compile compliance data in a database; properly dispose of samples; draft Discharge Monitoring Reports, (DMR); support Pretreatment activities; hold all original documentation on-site for a minimum of 5 years; archive the documentation for additional 10 years.

The management of the Water Quality Sampling and Monitoring Quality Assurance Plan is the responsibility of the Sampling and Monitoring Coordinator. She will be assisted by Senior Environmental Specialists and an Environmental Technician who will perform the actual duties of monitoring, sampling, testing, delivering, calibrating, record keeping and other functions needed to comply with compliance monitoring requirements. Please see the Public Works Organizational chart in Appendix A, and job descriptions in Appendix C.

The focus of this QAP is to describe the protocols, methods and procedures to be used by the Water Quality Sampling and Monitoring Group to meet the QAP requirements listed in NPDES permits ID002044-3 and ID002398-1.

A5. Problem Definition/Background

The purpose of the Quality Assurance Plan (QAP) is to document compliance plans for SAM and to provide a project-specific "blueprint" for obtaining the type and quality of data needed for a specific decision or use. The QAP documents how quality assurance (QA) and quality control (QC) are applied to an environmental data operation to assure that the results obtained are of the type and quality needed and expected.

This Quality Assurance Plan (QAP) applies to all data generated for compliance to the requirements contained in the Boise City's two NPDES permits, ID002044-3 and ID002398-1. This document

complements the *Water Quality Laboratory Quality Assurance Manual*, Boise City Public Works Dept. rev.5 2013. This manual contains the specific details, often in SOP format, of how the laboratory structures its quality system, defines and assigns QA and QC responsibilities, and describes the processes and procedures used to plan, implement, and assess the effectiveness of the quality system. The Quality Assurance manual is the "umbrella" under which individual projects are conducted.

The QAP is to be revised as needed to be kept current. The review and approval process is to be the same for revisions as the original plan. At a minimum, annual review by the Project Manager(s) is required. The Project Manager for this QAP is the WQ Sampling and Monitoring Coordinator.

A6. Project/Task Organization and Schedule

The sampling and testing regime is designed to meet the requirements of the two NPDES permits and the operational needs at the West Boise and Lander Street wastewater treatment plants. The Water Quality Sampling and Monitoring Group is staffed Monday through Friday from 7 AM to 4:30 PM with some weekends, and is closed for City recognized holidays. Boise's Water Quality Laboratory is open Monday through Saturday and staffed from 7 AM to 3:30 PM, with the possible exceptions of holiday weeks. The NPDES sampling schedule is developed using the laboratory information system (LIMS) software which contains a "sample scheduler" module in which the QA/QC Coordinator or her designee pre-loads scheduled samples along with the required analyses. Receiving water compliance monitoring usually occurs on Tuesdays (except for holidays) but exceptions and additional monitoring (Whole Effluent Toxicity, Priority Pollutants, etc.) scheduling is developed by the Senior Environmental Specialist in consultation with the Laboratory QA/QC Coordinator.

In the event a parameter or sample is overlooked, or the testing fails to produce reportable results, another sample is collected as soon as possible for analysis. Changes in the sampling or testing schedules can be made at the discretion of the WQ SAM Coordinator, QA/QC Coordinator, or the Laboratory Manager.

The sampling plan for receiving water monitoring is as follows:

Table 1. Boise River monitoring sites and analytes.

	Units	Veteran's	Glenwood	Eagle
BOD	mg/L	Monthly	Monthly	
TSS	mg/L	Monthly	Monthly	
Dissolved Oxygen	mg/L	Continuous	Continuous	Continuous
Total Phosphorus	mg/L	Weekly	Weekly	Weekly
Total Ammonia	mg/L	Monthly	Monthly	
Total Kjeldahl Nitrogen	mg/L	Quarterly	Quarterly	
Nitrate-Nitrite	mg/L	Quarterly	Quarterly	
Hardness as CaCO3	mg/L	Monthly	Monthly	Monthly
Alkalinity as CaCO3	mg/L	Monthly	Monthly	
Temperature	C	Continuous	Continuous	Continuous

pH	standard units	Weekly	Weekly	
Oil and Grease	mg/L	Quarterly	Quarterly	
Total Organic Carbon	mg/L	Monthly	Monthly	Monthly
Turbidity	NTU	Quarterly	Quarterly	
Aluminum (dissolved)	µg/L	Quarterly	Quarterly	
Aluminum (total)	µg/L		Quarterly	
Arsenic (total)	µg/L	Monthly	Monthly	
Cadmium (dissolved)	µg/L	Monthly	Monthly	Monthly
Cadmium (total)	µg/L		Monthly	Monthly
Chromium (dissolved)	µg/L	Quarterly	Quarterly	
Copper (dissolved)	µg/L	Monthly	Monthly	Monthly
Copper (total)	µg/L		Monthly	Monthly
Cyanide	µg/L	Monthly	Monthly	
Iron (dissolved)	µg/L	Monthly	Monthly	Monthly
Lead (dissolved)	µg/L	Monthly	Monthly	Monthly
Lead (total)	µg/L		Monthly	Monthly
Selenium (total)	µg/L	Quarterly	Quarterly	
Mercury (total)	µg/L	Monthly	Monthly	Monthly
Silver (dissolved)	µg/L	Monthly	Monthly	Monthly
Silver (total)	µg/L		Monthly	Monthly
Nickel (dissolved)	µg/L	Quarterly	Quarterly	
Zinc (dissolved)	µg/L	Monthly	Monthly	Monthly
Zinc (total)	µg/L		Monthly	Monthly
E. coli bacteria	colonies/100 ml	Monthly	Monthly	

SAM staff also collect samples for Whole Effluent Toxicity (WET) Testing and Priority Pollutants at intervals set in the permits and specific dates are determined in consultation with the Laboratory QA/QC Coordinator. Currently, the WET tests are conducted in one of four time frames: January-April, May-June, July-September, and October-December. Priority Pollutants are to be collected in the 2nd, 3rd and 4th year of the permit and are tentatively scheduled for October.

A7. Data Quality Objectives and Criteria for Measuring Data

There are individual data quality objectives, DQOs, for each test done in the laboratory. These objectives are expressed in control charts for the test that outline warning and control limits for parameters such as initial LCS, blank, RPD, percent spike recovery, and ending LCS. Results for these parameters are recorded on the control charts for every sample set tested or recorded in LIMS. Method Detection Levels (MDLs) and Minimum Levels (MLs) for laboratory analyzed parameters are maintained by the Laboratory Staff and databases are maintained by the Laboratory QA/QC Coordinator. The most current MDL list is found online at I:Lab:QAQC:MDL : WQLABMDLS.

It is the objective of the SAM Group to provide the Water Quality Laboratory with representative, accurate and reliable data to meet compliance monitoring requirements. The quantity of data to be collected is determined in the NPDES permits for each receiving water location. The data quality issues of precision, accuracy, bias, representativeness, completeness, and comparability are described in the following sections.

Precision, Accuracy, and Bias

Precision is the agreement of a set of results among themselves and is a measure of the ability to reproduce a result. Accuracy is an estimate of the difference between the true value and the determined mean value. The accuracy of a result is affected by both systematic and random errors. Bias is a measure of the difference, due to a systematic factor, between an analytical result and the true value of an analyte. Precision, accuracy, and bias for chemistry analyses may be measured by one or more of the following quality assurance/quality control (QA/QC) procedures:

- collection and analysis of field replicate samples and various field blanks such as atmosphere, bottle, filtration, and equipment blanks; and
- analysis of various laboratory QC samples such as method blanks, matrix spikes, certified reference materials, and laboratory replicates.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at the sampling point, or an environmental condition. Water quality data are collected on a routine frequency and are separated by approximately even time intervals. The permits specifically require that some parameters are to be collected using grab sample methods (pH, mercury, oil and grease, etc.). Water samples for trace metals and conventional analyses will be collected from the three stations using USGS equal width increment (EWI) sampling techniques to obtain a sample that is representative of the river from top to bottom and across the entire channel width. The continuous water quality data collection sites were constructed to be permanent; electronic *in situ* water column data is collected at the same location each day.

Completeness

Completeness is defined as the total number of samples analyzed for which acceptable analytical data are generated, compared to the total number of samples submitted for analysis. The goal for completeness is 100%. Adherence to standardized sampling and testing protocols will aid in providing a complete set of data for permit compliance. Because the samples are required for permit compliance, it is unlikely that the data quality objectives can be met if additional samples are not collected and analyzed. The data will be considered complete when the NPDES permit required number of samples has produced valid, defensible data.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Confidence in the comparability of data produced by the SAM group is founded on the commitment of staff to use only approved sampling and analysis methods and QA/QC

protocols in accordance with quality system requirements and as described in this QAP, and the *Water Quality Sampling and Monitoring Program Procedures Manual*.

A8. Training Requirements/Certification

While most of the sample collection training occurs on the job (OTJ), employees receive site specific training at initial employment orientation, safety training, as well as vendor and manufacturer training on new and upgraded equipment. Independent study is encouraged and supported as much as possible.

All field personnel must be familiar with general environmental sampling procedures, must read the *Water Quality Sampling and Monitoring Program Procedures Manual* containing specific Standard Operating Procedures (SOPs) and the *Water Quality Section Health and Safety Plan*.

Reference materials, webinars and occupational literature are available for review by SAM staff. Required reading is routed to all SAM staff. Additionally, night school classes, outside reading, subject research on the internet, attendance at in-house or external seminars, or professional society meetings, etc. on a voluntary basis are encouraged. Employees may consult the SAM Coordinator for information on tuition and fee payments by the City.

The Sampling and Monitoring Coordinator is responsible for setting training requirements and maintaining records. During the annual employee performance review with the SAM Coordinator, additional training needs are identified and an action plan proposed.

SAM Audits

The use of approved equipment and approved methods when collecting must be confirmed by periodic verification that the equipment and methods are being employed properly. The verification is accomplished by performing audits. Audits of field sampling techniques will be conducted periodically by USGS staff independent of the actual duties of either the data collector or laboratory management. This person will be familiar with the field sampling requirements of the program. A written summary of the audit findings will be distributed to the SAM Coordinator and the Laboratory Manager and/or Laboratory QA/QC Coordinator.

A9. Documentation and Records

Project documentation includes:

- This QAP
- *Water Quality Sampling and Monitoring Program Procedures Manual*
- *Water Quality Section Health and Safety Plan*
- Field notes (recorded on pre-printed forms)
- Instrument calibration logs
- Instrument maintenance logs

- Chain-of-Custody forms

The WQ SAM Coordinator will ensure that project plans (QAP, *Water Quality Sampling and Monitoring Program Procedures Manual,* and the *Water Quality Section Health and Safety Plan*) are revised as needed. The QAP revision date as well as the revision date for each SOP in the *Water Quality Sampling and Monitoring Program Procedures Manual* will be printed in footer on each page of these documents. Revised QAPs are distributed to individuals listed in A3.

Field notes, maintenance records and instrument calibration records will be recorded on preprinted forms. At a minimum, field notes will include the name(s) of the person(s) conducting the subject activities, sample locations, equipment used, and any observations deemed unusual by field personnel. Chain-of-custody records will document transmission of the samples from field to laboratory personnel.

All NPDES Program related records will be maintained for a minimum of five years, or until the date of the next permit renewal, whichever is greater.

B1. Sampling Process Design

The sampling schedule and tests described in section A6 will be used to meet the requirements of the NPDES permit. SAM group NPDES sampling and monitoring tasks can be separated into four areas:

- Boise River weekly monitoring
- Boise River continuous water quality monitoring stations
- Whole Effluent Toxicity testing
- Priority Pollutants

Boise River Weekly Monitoring

The NPDES permit specifies the number of samples to be collected, as well as the types of field measurements and laboratory analyses to be performed (Table 1). The locations of the three Boise River receiving water monitoring sites are presented in Figure 1. The Boise River at Veteran's Parkway, Glenwood Avenue, and Eagle Road (S Channel) were selected by the City of Boise (as directed by the permit) to represent conditions upstream and downstream of both wastewater treatment plants.

The river is sampled weekly, usually on Tuesdays (unless a holiday falls on Tuesday). Additional parameters are added monthly and quarterly. The schedule itself is designed to leave time for reruns as needed/requested and meet holding times for the samples. Changes are made at the discretion of the SAM Coordinator, QA/QC Coordinator and/or the Laboratory Manager.

Individual SOPs for water sample collection are included in the *Water Quality Sampling and Monitoring Program Procedures Manual*.

When possible, field duplicates are used to assess the temporal/spatial variability of the matrix and impacts of sampling techniques. For river monitoring, field duplicate minimum frequency is monthly, unless a higher frequency is deemed helpful for a special study. To assess bottle preparation, field

equipment cleanliness and crew technique, the following QC samples are added: trip blank, field blank, equipment blank. The frequencies of these samples are at least quarterly, but may be increased to support a special study or to follow up on previous detections. A field blank for low level mercury is collected at each river site to assess background contamination, since the required Hg method detection limit is 0.2 ng/ L.

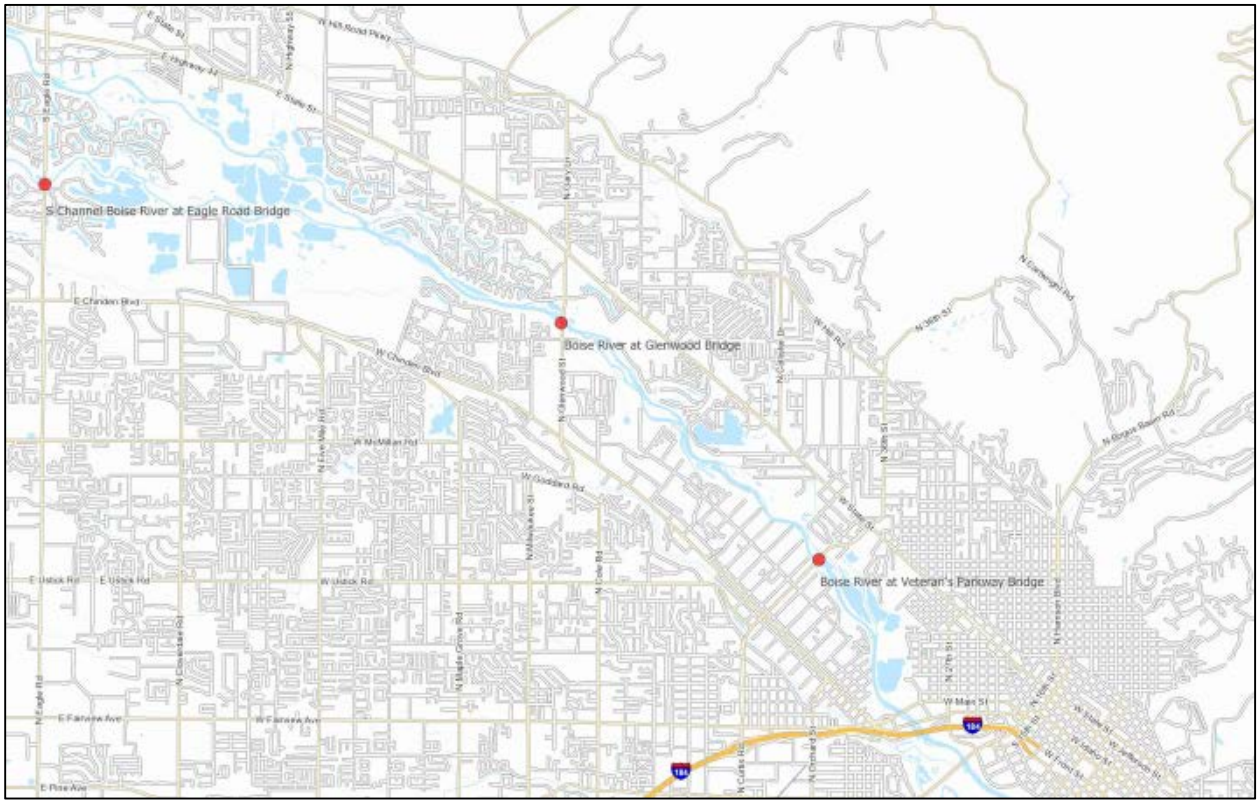

Figure 1. Locations of the Boise River receiving water monitoring locations.

Boise River Continuous Water Quality Monitoring Stations

The NPDES permits direct the City of Boise to monitor the Boise River continuously for dissolved oxygen and temperature to determine long term impacts on the water quality due to wastewater treatment plant effluent and storm-water runoff.

Yellow Springs Instruments (YSI) Series 6000 Multi-parameter loggers and Hobo TidBit temperature loggers are installed at the three locations on the Boise River. Figures 2-4 detail their location.

Specific SOPs to address temperature logger recording, YSI data collection and YSI data processing are included in the *Water Quality Sampling and Monitoring Program Procedures Manual*. In brief, temperature data is collected in 15 minute intervals and is downloaded, and summarized, monthly. YSI instruments are checked/calibrated monthly; data is downloaded daily and summarized monthly.



Figure 2. Boise River WQ monitoring station at Veteran's Parkway.



Figure 3. Boise River WQ station at Glenwood Avenue.



Figure 4. Boise River WQ station at Eagle Rd. (S Channel)

Whole Effluent Toxicity Testing

The current NPDES permits require chronic WET tests be conducted during the following time periods: January-April, May-June, July-September, and October-December for the duration of the permits, as well as accelerated retesting (i.e., six biweekly retests) if "toxicity triggers" are exceeded. The specific SOP detailing the planning, sample collection, processing, and shipping is included in the *Water Quality Sampling and Monitoring Program Procedures Manual*. Briefly, three, 24 hour composite samples are collected from the wastewater treatment plant effluent samplers (maps of effluent sampler locations are included in the Lander Street and West Boise Wastewater Treatment Plant QAPs) and shipped to a contract laboratory for analysis.

Priority Pollutants

The current NPDES permits require Expanded Effluent Testing ("Priority Pollutants") to be conducted in the 2nd, 3rd, and 4th years of the permit. Testing is to be conducted on the same day as a whole effluent toxicity test. Parameters to be sampled for are included in the NPDES Permit Application Form 2A, Part D. The specific SOP for Priority Pollutant sampling is included in the *Water Quality Sampling and Monitoring Program Procedures Manual*. Briefly, composite samples are collected from the wastewater treatment plant effluent samplers (maps of effluent sampler locations are included in the Lander Street and West Boise Wastewater Treatment Plant QAPs) and shipped to a contract laboratory for analysis.

B2. Sampling Methods Requirements

The specific test being performed on the sample determines the method of sampling (grab vs. composite; defined in the permit), the type of container used to collect the sample, sample preservation and holding times. The specific requirements are contained within the Laboratory QA Manual and in the Laboratory SOPs for each test. In the absence of direction, Table II Required Containers, Preservation, Techniques and Holding times in 40 CFR 136 is the primary reference for NPDES compliance. If more information is needed then Table 1060: I Summary of Special Sampling or Handling Requirements found in the most recently approved edition of *Standard Methods for the Examination of Water and Wastewater* is used.

The equipment, materials, and special techniques necessary to gather each analyte (e.g., pumps, filters, containers, "clean chemistry") are described in the Laboratory QA-QC manual or test SOP. In addition, any procedures to clean or decontaminate equipment prior to or during sample collection to prevent contamination of existing samples, or in order to prepare for the next sampling, are also defined by SOP. Analytical method minimum volumes, number of specimens, preservatives, and holding times and conditions (e.g., temperature control) are described in the QA-QC manual as well.

Recording Data

Field personnel follow the basic rules for recording information as documented below:

- Loose-leaf field notes and field forms may be recorded legibly in indelible ink (preferred) or pencil with no erasures, modifications, write-overs or multi-line cross-outs.
- Bound field notes and forms and in-house field and lab records (multiprobe calibration logs, bench logs, etc.,) must be recorded in indelible ink with no modifications, write-overs or multi-line cross-outs.
- Errors are to be corrected with a single line-through followed by initials and a date.

B3. Sample Handling and Custody

Boise River receiving water samples collected by the SAM group are submitted to the City of Boise Water Quality Laboratory or contract laboratory with a Chain-of-Custody (COC) form. The chain-of-custody is necessary to ensure sample integrity from the time of sample collection through data reporting. This includes the ability to trace possession and handling of the sample from the time of collection through the final disposition. River COC forms are included in Appendix D. The chain-of-custody accompanies each sample or group of samples and includes who it was delivered by, the delivery date and time, sample identification, the time of collection and identifies who collected the sample and analysis to be performed. A COC is also used to accompany specific samples to outside laboratories for conducting specified tests. This form includes the sample name, an ID code, date of sample collection and receipt, and analyses to be performed.

B4. Analytical Methods Requirements

The analytical requirements for the Boise River sampling are based on the NPDES permit. Field measurements provide pH, temperature, dissolved oxygen, and turbidity data. Additional water quality data is provided by laboratory analyses of grab and composite samples. Table 2 identifies the components to be collected by grab sampling and by composite sampling and the analytical methods to be used. For NPDES compliance monitoring, only methods approved by 40 CFR Part 136.4, the USEPA under that program that will be used, or unless an alternative testing procedure has been approved by EPA Region X.

The Laboratory QA manual contains the SOPs for each test and is based upon standard referenced methods as relevant to the specific project. Field measurements are taken in a similar way to those in the laboratory. Due to the volume of information, the QA manual and the multitude of individual SOPs are kept electronically on the "I" drive I: Lab: Lab Procedures: SOPs.

Table 2. Boise River receiving water sampling and analytical methods.

Analyte	Grab, Composite, or Continuous	Analytical Method
BOD	Composite	SM5210B
TSS	Composite	SM 2540 D
Dissolved Oxygen (field)	Continuous	ASTM D888-09 (C)
Total Phosphorus	Composite	EPA 365.1
Total Ammonia	Composite	EPA 350.1
Total Kjeldahl Nitrogen	Composite	PSTORP PAI-DK01
Nitrate-Nitrite	Composite	EPA 353.2
Hardness as CaCO3	Composite	SM 2340 B
Alkalinity as CaCO3	Composite	GS I-2030-85
Temperature	Continuous	EPA 170.1
pH (field)	Grab	SM 4500 -H B
Oil and Grease	Grab	EPA 1664A
Total Organic Carbon	Composite	SM 5310B
Turbidity (field)	Three grab composite	EPA 180.1 R2.
Aluminum (dissolved)	Composite	EPA 200.7
Aluminum (total)	Composite	EPA 200.7
Arsenic (total)	Composite	EPA 200.8
Cadmium (dissolved)	Composite	EPA 200.8
Cadmium (total)	Composite	EPA 200.8
Chromium (dissolved)	Composite	EPA 200.8
Copper (dissolved)	Composite	EPA 200.8
Copper (total)	Composite	EPA 200.8
Cyanide	Three grab composite	Lachat 10-204-00-1-A
Iron (dissolved)	Composite	EPA 200.7
Lead (dissolved)	Composite	EPA 200.8
Lead (total)	Composite	EPA 200.8

Selenium (total)	Composite	EPA 200.8
Mercury (total)	Grab	EPA 1631 E
Silver (dissolved)	Composite	EPA 200.8
Silver (total)	Composite	EPA 200.8
Nickel (dissolved)	Composite	EPA 200.8
Zinc (dissolved)	Composite	EPA 200.8
Zinc (total)	Composite	EPA 200.8
E. coli bacteria	Grab	Colilert QT

B5. Quality Control

Procedures to verify the quality of measurements are performed at various stages of data collection. Standard, documented procedures will be used for all field measurements and activities. Reasons for the use of nonstandard procedures will be clearly documented in the field notes. Field QC samples include field blanks, field duplicate samples, trip blanks and equipment blanks.

The Water Quality Laboratory performs additional QA/QC determinations as part of their internal QA/QC. Laboratory Quality Control requirements (function checks and control checks) and corrective action procedures are contained within the Laboratory QAP.

B6. Instrument/Equipment Testing, Inspection and Maintenance

To minimize downtime of measurement systems, all field sampling and laboratory equipment must be maintained in working condition. Backup field equipment and/or commonly needed spare parts will be available so that if any piece of equipment fails during use, repairs or replacement can be made as quickly as possible, and the measurements resumed. Before any water sample collection begins, availability of proper equipment should be verified. This includes sampling equipment, safety equipment, and field measurement equipment (with calibration standards).

Field Equipment

All field equipment that has a manufacturer's recommended schedule of maintenance will receive preventive maintenance according to that schedule unless otherwise described in Water Quality Sampling and Monitoring Equipment that does not include a manufacturer's maintenance schedule should be verified that it is in working condition at least annually and especially prior to being taken into the field. Common spare parts that should be available include, but are not limited to, batteries and multiprobe parts. After use in the field, all equipment will be re-evaluated as to the need for maintenance.

Laboratory Equipment

Testing and maintenance requirements for laboratory equipment are contained in the laboratory QA manuals or in maintenance documents provided by the manufacturer. Due to the cost of some laboratory equipment, back up capability may not be possible.

B7. Instrument Calibration and Frequency

Calibration requirements for field equipment are contained in the *Water Quality Sampling and Monitoring Program Manual*. Each instrument is calibrated according to the SOP for the test. Documentation that instrumentation is functioning properly to allow generation of the highest data quality is demonstrated by the reading of a LCS, which is made from a NIST certified, second source (IE. manufacturer) than the calibration standards. All calibrations are documented on bench sheets or calibration log books. At a minimum, the calibration procedure and frequency recommended by the manufacturer or as specified by a method will be used and is documented in the SOP. Data from field equipment not meeting calibration and post-calibration error limit requirements are not entered into the LIMS database.

Detailed information on the calibration of laboratory instruments is contained in the laboratory quality manual(s) and/or SOPs.

B8. Inspection and Acceptance of Supplies and Consumables

All supplies, reagents, and analytical standards used during sampling and analysis meet strict acceptance criteria. Most supplies are purchased through a major national scientific warehouse and are marketed for the applied use. Chemicals which show evidence of leaks, freezing or other damage during shipping are rejected. Upon arrival of materials or equipment, a designated employee receives and signs for the materials. The program staff that initiated the order is responsible for inspecting and verifying equipment and supplies upon receipt. Items are reviewed to verify that the shipment is complete, and the items are then delivered to the proper location. All chemicals are dated upon receipt. All supplies are stored appropriately and are appropriately disposed of upon expiration date.

In the field, supplies will be visually inspected for evidence of cleanliness and any items showing visible contamination or damage will be discarded unused. Disposable nitrile gloves will be inspected for contamination upon receipt. Any boxes carried to the field (outside of the mobile laboratory) will be kept in a plastic bag during transportation.

Additionally, the use of method blanks, field blanks, analytical blanks and laboratory control standards (LCS) provides continual validation that supplies and reagents are suitable.

B9. Data Acquisition Requirements (Non-Direct Measurements)

In order to meet the reporting requirements for NPDES compliance, data generated is sent to Laboratory Manager and QA/QC Coordinator. Analytical results (river temperature and dissolved oxygen data) conducted by SAM staff are summarized and transferred electronically to the Laboratory QA/QC Coordinator.

Whole Effluent Toxicity testing reports are reviewed by the SAM Coordinator and forwarded to the Laboratory Manager and QA/QC Coordinator.

B10. Data Management

All field data forms or field log books are completed by the operator who performed the test. Procedures for filling out the field forms and log books and subsequent data entry are provided in the SOPs for the individual tests. After transfer to the laboratory, data entry, validation, and verification functions are all integrated into the Laboratory LIMS database.

To ensure uniform data are reported, the following rules are adopted:

1. Results are to be expressed in the appropriate number of significant figures.

2. Results are to be rounded as follows: if the first digit to the right of the place the result is to be rounded is greater than 5, increase the previous digit (the digit, once rounded, that will be the last digit in the reported result) by l. [Example: 432.355 is to be rounded to the tenths place. The rounded number would be 432.4.] If the first digit to the right of the place the result is to be rounded is less than 5, the previous digit (the digit, once rounded, that will be the last digit in the reported result) stays the same. [Example: 432.355 is to be rounded to the tens place. The rounded number would be 430.] If the digit to be rounded off is 5 (nothing following the digit 5), increase the previous digit by 1, if the previous digit is odd. [Example: 4.565 are to be rounded to the hundredths place. The rounded number would be 4.56.] Drop the 5, if the previous digit is even. [Example: 5.2345 are to be rounded to the thousandths place. The rounded number would be 5.234.]

At a minimum, five years of bench sheets, calculation sheets, log books, raw data print outs, and analysis reports are kept on-site or until a new permit is issued, whichever occurs first.

C1. Assessment and Response Actions

Program assessment is continual and multi-faceted. Analytical results are compared to historical values with automatic warning generated at data entry by using limits set within the LIMS software. If an unusual value is seen, the Laboratory Manager will notify the SAM Coordinator. Notification, corrective actions, and follow-up reporting as required by the NPDES permits are administered by the Operations Manager. Upon notification of unusual value, the SAM Coordinator initiates an investigation to determine cause and or corrective action and schedules a retake.

Blind performance samples are used within the lab to assess lab performance. The laboratory participates in annual EPA DMR-QA studies plus USGS studies. Individual lab analysts receive blind samples and a method review each year (see Section A8.)
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C2. Reports to Management

Monthly DMRs are completed by the Operations Manager and QA/QC Coordinator, reviewed and signed by the Operations Manager, photocopied and distributed by administration staff. The posting deadline is the 20th of the following month.

Additional data collected to support Whole Effluent Toxicity studies and permit negotiation efforts are attached to these reports.

D1. Data Review, Validation and Verification Requirements

Data validation is the process in which data are checked and accepted or rejected based on a set of established criteria. This involves a critical review of a body of data in order to identify atypical values or outlying observations. The review may be only a quick scan to detect extreme values or a detailed evaluation by the LIMS database. In either situation, when an atypical value is identified, it is checked for validity. Records of values that are judged to be invalid or are otherwise doubtful will be retained. In some cases, an investigation report is generated by the QA/QC Coordinator and kept in files for 3 years on-site. In other cases, a note is made on the bench sheet and an explanation placed under "sample comments" in the LIMS data system. In all cases, an explanation and justification is provided.

D2. Validation and Verification Methods

Data validation will be performed by the SAM Senior Environmental Specialist performing the data collection. The SES will review field data sheets for completeness and for circumstances which might adversely affect data quality (such as apparently erroneous field measurements or unclear writing). Extreme and outlier values will be considered indicators of unusual conditions or possible data collection and recording errors. These values will be evaluated on a case by case basis. The SAM Coordinator will consult with the Laboratory QA/QC Coordinator in the event of outliers or unexpected values.

D3. Reconciliation with Data Quality Objectives

The activities specified in elements D1 and D2 will be used to assess the degree to which the DQOs have been met. The SAM Coordinator will initiate appropriate corrective action in the event that DQOs have not been met.

Appendix A. Public Works Organizational Chart

Appendix B. Contact List for Public Works – Environmental Senior Staff Involved with NPDES Compliance

Title	Name	Telephone Number
Environmental Manager	Paul Woods	208-384-3942
WQ Manager	Robbin Finch	208-384-3916
WQ SAM Coordinator	Kate Harris	208-395-7877
WQ Laboratory Manager (Operations Division)	Janet Finegan-Kelly	208-608-7263

Appendix C. Job Descriptions of Water Quality Sampling and Monitoring Group Staff Involved with NPDES Compliance

- Water Quality Environmental Coordinator
- Water Quality Senior Environmental Specialist
- Water Quality Environmental Technician

Water Quality Environmental Coordinator

SUMMARY STATEMENT:

Responsible for researching, developing, and implementing surface water quality monitoring plans, ordinances, and policies. Evaluates laws and regulations, reviews technical reports, and comments on regulatory proposals or actions. Oversees laboratory contractors and maintains databases related to surface water quality. Through subordinate technical staff, performs a variety of wastewater and surface water sampling and monitoring functions. Work requires considerable independent judgment.

ESSENTIAL FUNCTIONS:

Develops water quality sampling programs for surface water related programs and regulatory issues to match Cityï¿½s current projects or needs. Develops and maintains databases of continuous water quality monitoring data for Boise River sites. Generates statistics to support Total Maximum Daily Load (TMDL) evaluation. Maintains temperature monitoring network database and West Boise and Lander Street Wastewater Treatment Plants (WWTP) effluent temperature databases for future modeling efforts or data requests. (30%)

Implements sampling and monitoring program to meet National Pollutant Discharge Elimination System (NPDES) permit requirements. Reviews Whole Effluent Toxicity test results and data to be included on

Discharge Monitoring Report (DMR). Manages the collection of data relating to water quality and quantity for the purpose of supporting the City of Boise billing activities. Approves schedules, standard operating procedures (SOPs), and reviews Chain of Custody (COC) forms and technical reports. Tracks technology to increase data collection efficiency and improve data quality. Develops and provides input to workgroup and department work plans and budget processes. Sets employee performance standards and evaluates results. Accompanies field staff on special site evaluations or on field work, when necessary. (20%)

Provides water quality technical expertise to other departments of the City. Reviews storm water program monitoring plans, annual reports, SOP's, data and analysis. Assists Parks and Recreation Department on special projects (eg. Quinnï¿½s Pond algae control). (20%)

Participates in water quality standards and criteria development, reviews, and negotiated rulemaking. Comments on regulatory proposals or actions, reviews NPDES permit, and interprets technical water quality data to assist in the development of policy and procedures. Coordinates with management to formulate City response on regulatory actions or proposals. Acts as liaison with regulatory agencies and other entities and is responsible for surface water issues. (10%)

Creates and delivers presentations for City of Boise educational outreach programs and activities. Participates in inter-agency committees and projects. Responds to public questions and concerns regarding water quality. Develops and presents "Boise WaterShed Watch!" training events. Works with WaterShed staff to create water quality classes and curricula. Develops and provides information for the Environmental Data page on the Boise Environmental Education website. Participates in Boise River Research Collaboration activities. (10%)

Supervisory responsibilities: Employees in this position are authorized to recommend and/or effect the full range of duties (with appropriate managerial review), including hiring, performance evaluations, transferring, promoting, assigning of significant duties, rewarding, disciplining and terminating employment; exercise independent judgment to direct others work and have the authority to take corrective action; and, utilize people skills to communicate, motivate and direct or oversee a person, group, department, or organization. (10%)
Performs other duties as assigned. Nothing in this job description restricts management's right to assign or reassign duties and responsibilities to this position at any time. Total Percentage = 100%

REQUIREMENTS:

Required Knowledge, Experience, and Training

Must have a Bachelor’s degree in Natural Resource Management, Environmental Science, Chemistry, or related field.

Requires education and/or experience to attain the following:

Five years professional level experience in the field of water, or environmental quality including two years in a management or supervisory role, or an equivalent combination of experience and/or education.

Advanced knowledge of principles, theories, methods and techniques of watershed, water resources, and natural resources management and environmental protection; strategic planning and policy analysis, development and implementation; wastewater sampling and laboratory analysis techniques; local, state and federal laws and regulations pertaining to the work; principles and practices of project management, including developing project schedules, work plans, and budget preparation and administration; statistical analysis and computer software applications related to the work.

Working knowledge of principles and practices of public administration, including purchasing, contracting and maintenance of public records; principles and practices of public outreach and involvement; and principles, practices of effective management and supervision.

Ability to analyze complex environmental issues and problems, evaluate alternatives, and recommend policies and effective courses of action; develop and manage projects including contract and budget administration; perform mathematical calculations and analyze water quality data; interpret laws, regulations and technical information; prepare clear and concise records, technical reports, correspondence and other written materials; present conclusions clearly, logically and persuasively to both internal and external program stakeholders; facilitate group and individual discussions to identify and resolve differences and achieve results; exercise independent judgment and initiative within general policy guidelines; display an attitude of cooperation and work harmoniously with the media, businesses, contractors, special interest groups, co-workers and the public all levels of City employees, the general public and other organizations; communicate effectively in the English language at a level necessary for efficient job performance; complete assignments in a timely fashion; understand and comply with all rules, policies and regulations; maintain prompt and regular attendance; perform all essential and marginal functions as assigned by an authorized employee, supervisor and/or manager with or without a reasonable accommodation.

Individuals must be capable of operating vehicles safely and have an acceptable driving record.

Preferred Knowledge, Experience, and Training

Master’s degree in Natural Resource Management, Environmental Science, Chemistry, or related field, and six years natural resources management and environmental protection or compliance experience of which three or more years in a supervisory capacity. Experience in a state level environmental regulatory program or local government approved pretreatment program is preferred.

Licensing and Other Requirements

Valid Idaho driver's license.

Special Requirements

All applicants must be able to successfully pass City of Boise background check processes which include reference checks and criminal history checks.

Applicants must be able to pass, or have:

Driving Record Check

Education Verification

WORKING CONDITIONS:

The physical effort characteristics and working environment described here are representative of those an employee encounters while performing the essential functions of this job. Reasonable accommodations may be made to enable individuals with disabilities to perform the essential functions.

Physical Efforts
While performing the duties of this job the employee is frequently lifting/carrying up to 10 lbs, occasionally lifting/carrying up to 35 lbs, rarely lifting/carrying up to 75 lbs. Also the employee is occasionally pushing/pulling up to 50 lbs, rarely pushing/pulling up to 100 lbs. The noise level is rarely very loud. Work includes sensory ability to talk, hear, touch and feel. Work in this position also includes close vision and distance vision. Employees will sit, stand, walk, stoop, kneel, crouch, crawl, reach and grasp. Position requires hand/finger dexterity.

Working Environment
The work environment will include inside conditions, outdoor weather conditions, extreme temperatures, in wet and humid conditions, with areas of dust, odors, mist, gases or other airborne matter. Employees work in/at heights, confined spaces and are exposed to mechanical hazards. Employees will also drive a vehicle as part of this position. Field work includes walking up and down stream banks or pond edges, ice, and traffic. Work includes protected exposure to infectious bacteria, and chemicals. Additional environmental conditions include: Potential for exposure to West Nile virus while performing field work.
This position works: evenings, weekends, and holidays as required.

POSITION CONTROL NUMBER(S):
00001391, Public Works, Environmental, Sewer Environmental

PAY GRADE:
E13

JOB INFORMATION:
Position Type: Full-Time Regular, Benefits: Exempt, Hay Rating: EI3 264 E3(33) 87 D2P 115 -, Total Points: 466, FLSA: Administrative, EEO: Officials and Administrators, Reports To: Environmental Programs Manager

Water Quality Senior Environmental Specialist

SUMMARY STATEMENT:

Responsible for water quality sampling and monitoring project management which includes collection, analysis and reporting of environmental data to comply with federally issued permits, billing of industrial customers, and special water quality studies. Provides technical expertise and field support for the Environmental and Engineering Divisions, and other City departments for various environmental studies. Work requires technical expertise in water quality, industrial processes, sampling techniques, quality control and field safety procedures and is performed under general direction.

ESSENTIAL FUNCTIONS:

Schedules and coordinates between laboratories, field personnel, and equipment for field work related to the National Pollutant Discharge Elimination System (NPDES) permit, groundwater well sampling, Total Maximum Daily Load (TMDL) studies, sewer studies, industrial billing, geothermal billing and monitoring, and other special studies as assigned. Schedules field work and coordinates sampling and quality control with laboratory. Identifies sampling locations, creates traffic control plans, and provides GIS personnel with data to update maps with sampling sites for sewer work. Calibrates, maintains and troubleshoots scientific instruments and samplers. Conducts legally defensible sampling and analysis of the Boise River, sanitary sewer system, and wastewater treatment plants. Collects and submits Boise River temperature data each month to the Central Laboratory for its inclusion in the Discharge Monitoring Report, and creates data summary spreadsheets, graphs, analysis, and maintains data files. (30%)

Schedules and coordinates Significant Industrial User (SIU) wastewater sampling and geothermal billing monitoring between field personnel, laboratory, Utility Billing, and Geothermal Coordinator. Programs samplers, and collects samples from industrial clients. Reads geothermal meters, measures aquifer water levels and uploads depth/pressure monitoring instruments. Obtains and reviews industrial flow data, calculates monthly flows, reports data to Utility Billing and Central Laboratory for loading and billing requirements. Updates geothermal billing spreadsheet, submits data each month to Utility Billing and Geothermal Coordinator. Creates spreadsheets and graphs to analyze groundwater elevation trends, and maintains electronic data files. Consults with engineers, architects, industrial managers, municipal officials, and sewer district representatives on representative flow monitoring and sampling, and safety requirements for sampling stations. Prepares specifications and makes recommendations for flow monitoring, sampling equipment, and industrial sampling stations. (30%)

Consults with City personnel, engineering firms, municipal officials and researchers and develops Standard Operating Procedures (SOPs), for special projects. Examines safety related issues for each individual project, creates field forms in electronic format, schedules and conducts field work. Prepares summary report or compliance reports and associated notification letters. Maintains, operates and calibrates gas monitoring equipment. (25%)

Acts as a lead and oversees work of Environmental Technicians and Water Quality Assistants, and coordinates field and administrative work. Provides information for the preparation of annual budget

for field monitoring. Ensures field vehicles are scheduled for routine maintenance. Identifies and recommends necessary equipment needs, requests quotes from vendors, prepares purchase orders and procures the equipment and supplies necessary for the tasks. Prepares SOPs, reviews and applies water quality regulations and permits as related to the City's environmental and water quality programs. Maintains and updates water quality section safety plan. (15%)

Performs other duties as assigned. Nothing in this job description restricts management's right to assign or reassign duties and responsibilities to this position at any time. Total Percentage = 100%

REQUIREMENTS:

Required Knowledge, Experience, and Training

Must have a Bachelor's degree in Water/Wastewater Technology, Environmental Science, Biology or a related field.

Requires education and/or experience to attain the following:

Three years of professional level experience in the field of ground or surface water, air or environmental quality or an equivalent combination of education and/or experience.

Intermediate knowledge of inspection methods, sampling, and testing procedures used in obtaining and testing surface water, domestic and industrial wastewater, industrial wastes, and the related hazards; laboratory analysis techniques; federal and state laws and regulations relating to environmental programs; laboratory storage procedures and the means and techniques for collecting, storing and disposing of field samples; basic Geographic Information System concepts; general statistical analysis; terminology, methods and techniques used in engineering maps and records; data-gathering and research methods; standard office practices and procedures including manual and electronic file development and maintenance.

Ability to conduct field investigations and inspections; collect field data and samples and analyze and make recommendations regarding environmental data and sampling results; maintain technical files both electronic and manual; utilize specialized engineering, measuring, surveying, or electronic tools, materials and equipment; read and interpret field and laboratory notes; perform detailed work thoroughly, neatly, accurately and efficiently; work in rough terrain, manholes and sewers, performing very physical and strenuous work under hazardous working conditions, significant traffic risk and exposure to unknown chemicals; follow safety precautions when working at field sites; display an attitude of cooperation and work harmoniously with all levels of City employees, the general public and other organizations; communicate effectively in the English language at a level necessary for efficient job performance; complete assignments in a timely fashion; understand and comply with all rules, policies and regulations; maintain prompt and regular attendance; perform all essential and marginal functions as assigned by an authorized employee, supervisor and/or manager with or without a reasonable accommodation.

Individuals must be capable of operating vehicles safely and have an acceptable driving record.

Preferred Knowledge, Experience, and Training

Master's degree in Environment Sciences, Natural Resource Management, Environmental Management or related field, and four years of professional level experience in the field of ground and surface water or environmental quality.

Licensing And Other Requirements

Valid Idaho driver's license.

Special Requirements

All applicants must be able to successfully pass City of Boise background check processes which include reference checks and criminal history checks.

Applicants must be able to pass, or have:

Driving Record Check

Education Verification

WORKING CONDITIONS:
The physical effort characteristics and working environment described here are representative of those an employee encounters while performing the essential functions of this job. Reasonable accommodations may be made to enable individuals with disabilities to perform the essential functions.

Physical Efforts

While performing the duties of this job the employee is occasionally lifting/carrying up to 10 lbs, rarely lifting/carrying up to 50 lbs, occasionally lifting/carrying up to 100 lbs. Also the employee is rarely pushing/pulling up to 50 lbs, occasionally pushing/pulling up to 101 + lbs. The noise level is rarely loud. Work includes sensory ability to talk, hear, smell, touch and feel. Work in this position also includes close vision, distance vision, peripheral vision and depth perception. Employees will sit, stand, walk, stoop, kneel, crouch, crawl, reach, grasp, climb and balance. Position requires hand/finger dexterity. Additional physical efforts include: wading in streams and sewers; balancing on slippery rocks; climbing over trees and other obstacles as necessary; climbing into manholes.

Working Environment
The work environment will include inside conditions, outdoor weather conditions, extreme temperatures, in wet and humid conditions, with areas of dust, odors, mist, gases or other airborne matter. Employees work in/at confined spaces and are exposed to mechanical hazards. Employees will also drive a vehicle as part of this position. Periodic work in traffic; on sidewalks with heavy sampling equipment in all seasons and all types of weather. Work includes protected exposure to infectious bacteria, bodily fluids, and chemicals. Additional environmental conditions include: Potential exposure to West Nile virus while performing field work.
This position works: selected weekends each month required for industrial sampling.

POSITION CONTROL NUMBER(S):
00000286, Public Works, Environmental, Sewer Environmental
00000144, Public Works, Environmental, Sewer Environmental

PAY GRADE:
E12

JOB INFORMATION:
Position Type: Full-Time Regular, Benefits: Exempt, Hay Rating: EI2 230 D3(29) 66 D2C 76 8, Total Points: 380, FLSA: Professional, EEO: Professionals, Reports To: Environmental Coordinator

Water Quality Environmental Technician

SUMMARY STATEMENT:

Performs a wide range of detailed and technical water quality sampling, monitoring and administrative activities to support the City of Boiseï¿½s industrial billing programs, and permit compliance requirements under the federal Clean Water Act. This includes water quality sample collection, analysis and data reporting from surface water bodies, groundwater, wastewater treatment plants, and distribution systems to support various environmental programs. Ensures that sampling practices comply with all City policies and ordinances as well as with state and federal regulations. Maintains compliance documentation such as chain of custody sheets, laboratory compliance data logs internal tracking forms, and environmental databases. Work is performed independently with minimal supervision.

ESSENTIAL FUNCTIONS:

Collects wastewater samples, geothermal and water meter readings to support the Water Quality Sampling and Monitoring Group billing programs for regulatory compliance and revenue recovery. Collects representative Significant Industrial User (SIU) wastewater samples and records concurrent wastewater flows in a timely manner in accordance with City of Boise permits, procedures and laboratory requirements. Monitors geothermal use and water temperature or water use for over 100 customers. Programs, calibrates, maintains, troubleshoots, and performs corrective action on a variety of automated wastewater samplers. Maintains wastewater effluent flow recording devices; downloads flow data; summarizes use and transfers results to Public Works Revenue Officer. Maintains clear and accurate maintenance logs, event forms, and chain of custody forms. Notifies supervisor of unusual data or conditions. Works within safety guidelines to perform tasks utilizing personal protective equipment, safety practices, and mechanical controls. (45%)

Prepares laboratory instrumentation/equipment, supplies and samples for testing; performs highly detailed and technical sampling and analyses to quantify chemical, biological, and physical parameters in wastewater and freshwater systems. Calibrates equipment including barometers, dissolved oxygen meters, turbidimeters, and pH meters for field use. Conducts field QA/QC checks, preventative maintenance and performs corrective action on a variety of laboratory equipment. Measures legally defensible groundwater levels and collects representative samples for fluoride analysis, performs onsite pH and temperature analyses at groundwater injection wells and well pumphouses. Maintains accurate data records and sample custody forms. As part of the SAM work team, collects samples using isokinetic depth integrated sampling techniques (or other site or parameter specific methods) and sampling compositing methods to collect representative, lotic, surface water samples to meet National Pollutant Discharge Elimination System (NPDES) permit sampling requirements. Assists in sample splitting, filtration and preservation of samples for ultra low trace metal analysis using strict contamination prevention protocols. Measures stream discharge or interprets flow gaging devices. Assists with installation of flow meters, flumes, automated samplers and other sampling equipment into sewer lines and associated parts of the wastewater treatment process and distribution system, and assists in sample collection activities. (30%)

Completes many administrative tasks to support the Sampling and Monitoring Group. Participates in project planning activities, quality assurance/quality control program development and annual reviews, and field collection method external audits. Purchases supplies required for sampling and monitoring and attends safety and related training programs to meet City of Boise and Sampling and Monitoring Group standards and policies, and maintains continuing education credits for wastewater licensure. Performs various spreadsheet activities in Microsoft Excel and Access including the development and/or maintenance of spreadsheets, environmental data retrieval and conversion, spreadsheet calculations utilizing complex formulas, data interpretation, and creation of data summary tables/charts. (25%)

Performs other duties as assigned. Nothing in this job description restricts management's right to assign or reassign duties and responsibilities to this position at any time. Total Percentage = 100%

REQUIREMENTS:

Required Knowledge, Experience, and Training

Requires education and/or experience to attain the following:

Some post-secondary education and four years experience in environmental and water quality monitoring, supplemented by college-level courses in the theories and principles of water quality sampling, water chemistry and wastewater treatment operations, or an equivalent combination of education and/or experience.

Working knowledge of water quality sampling methods, flow monitoring equipment, and testing procedures used in obtaining and testing surface water, domestic and industrial wastewater samples and related hazards; materials and equipment used in treatment, discharge, and collection of industrial, commercial, and residential wastewater; of chemical and biological principles, terminology and techniques; ground water hydrology; laboratory practices and procedures; quality assurance/quality control methods and practices; basic water chemistry and metals behavior; legal requirements and regulations applicable to water quality sampling; standard office practices and procedures including manual and electronic file development and maintenance; methods and procedures for archiving and retrieving technical documents, maps, and drawings; computer software including Word, Excel, Access, PowerPoint; as well as time management software such as SumTotal and data management software

Ability to read maps, locate features, and interpret plans and diagrams; read and interpret specifications, draw sketches, and perform technical mathematical calculations; interpret and apply city, state, and federal policies, ordinances, laws, codes, rules and regulations; assist in developing programs; independently schedule and organize work assignments to ensure timely and effective completion; operate and utilize a wide variety of environmental monitoring instruments; comprehend complex technical written materials and laboratory reports; read and interpret water quality laboratory test results; prepare clear, accurate, technical reports summarizing data; ability to effectively communicate complex technical information both orally and in writing to City staff, other agencies, private industry and the general public; follow safety precautions when working at field sites; physically lift heavy or awkward equipment such as manhole covers; carry heavy or awkward equipment into sewer lines or industrial settings ; display an attitude of cooperation and work harmoniously with all levels of City employees, the general public and other organizations; communicate effectively in the English language at a level necessary for efficient job performance; complete assignments in a timely fashion; understand

and comply with all rules, policies and regulations; maintain regular attendance; perform all essential and marginal functions as assigned by an authorized employee, supervisor and/or manager with or without a reasonable accommodation.

Individuals must be capable of operating vehicles safely and have an acceptable driving record.

Preferred Knowledge, Experience, and Training

Bachelor's degree in Environmental Science, Biology, Natural Resource Management, Water/Wastewater Technology, or a related field, and four years experience in monitoring water and environmental quality.

Idaho Wastewater Operator's License, Class I or higher.

Licensing and Other Requirements

Valid Idaho driver's license.

Ability to obtain an Idaho Wastewater Operator Class 1 or Operator-in-Training license within six months of meeting Idaho Bureau of Occupational Licenses as eligibility requirements.

Special Requirements

All applicants must be able to successfully pass City of Boise background check processes which include reference checks and criminal history checks.

Applicants must be able to pass, or have:

Driving Record Check

WORKING CONDITIONS:

The physical effort characteristics and working environment described here are representative of those an employee encounters while performing the essential functions of this job. Reasonable accommodations may be made to enable individuals with disabilities to perform the essential functions.

Physical Efforts

While performing the duties of this job the employee is always lifting/carrying up to 35 lbs, occasionally lifting/carrying up to 101 + lbs. Also the employee is always pushing/pulling up to 35 lbs, occasionally pushing/pulling up to 75 lbs, rarely pushing/pulling up to 101 + lbs. The noise level is occasionally loud. Work includes sensory ability to talk, hear, smell, touch and feel. Work in this position also includes close vision, distance vision, peripheral vision and depth perception. Employees will sit, stand, walk, stoop, kneel, crouch, crawl, reach, grasp, climb and balance. Position requires hand/finger dexterity.

Working Environment

The work environment will include inside conditions, outdoor weather conditions, extreme temperatures, in wet and humid conditions, with areas of dust, odors, mist, gases or other airborne matter. Employees work in/at heights, confined spaces and are exposed to mechanical hazards. Employees will also drive a vehicle as part of this position. Subject to hazards associated with work at industrial sites, on roadways and bridges, in rivers and streams, and manholes or sewer lines. Work includes protected exposure to infectious bacteria, bodily fluids, and chemicals. Additional environmental conditions include: Potential exposure to West Nile virus while performing field work. This position works: Weekdays and rotating weekends and evenings. Occasional overtime for special projects or emergencies.

POSITION CONTROL NUMBER(S):
00000283, Public Works, Environmental, Water Quality

PAY GRADE:
N17

JOB INFORMATION:
Position Type: Full-Time Regular, Benefits: Non-Exempt, Hay Rating: DI2 175 C3(25) 43 CNS 50 8, Total Points: 276, FLSA: Non-Exempt, EEO: Technicians, Reports To: Environmental Coordinator

Appendix D. Boise River receiving water Chain-of-Custody forms.

Appendix C: Monitoring Program QA/QC Checklist

Monitoring Program QA/QC Checklist

A. Event and Data Completeness	Yes	No	N/A	Notes
1. Field data sheets filled out completely and clearly				
2. All samples collected as specified				
3. All samples delivered to lab promptly (review chain of custody rpts)				
4. Inconsistencies/clarifications discussed with sampling team member				
5. All analytical reports from lab received				

B. Validation and Verification Methods	Yes	No	N/A	Notes
1. Outliers and unexpected values discussed with lab				
2. Appropriate analytical methods used				
3. All lab QA samples were within method acceptance criteria				
4. All samples reviewed and data qualifiers assigned if needed				
5. Data quality objective achieved				

C. Program Specific Storm and Sample QA/QC Criteria	Type	Storm/ Sample Value	Program Criteria	Met	Qualify	Reject	Notes
Fill in with criteria specific to each monitoring program							

D. Follow Up Items:

Reviewed by_____**Date**_____ **Approved by**_____**Date**_____

Appendix D: City of Boise Water Quality Laboratory QAPP

CITY OF BOISE PUBLIC WORKS

WATER QUALITY LABORATORY

QUALITY ASSURANCE PROGRAM PLAN (QAP) FOR STORM WATER NPDES PERMIT COMPLIANCE

SEPTEMBER 26, 2014
REVISION 10

1. Title and Approval Sheet

Quality Assurance Program Plan (QAP)
For Storm Water NPDES Permit Compliance

Revision 10, September 26, 2014

Janet Finegan-Kelly
Janet Finegan-Kelly, Water Quality Lab Manager

Date: 10/6/14

Karen Griffin
Karen Griffin, Laboratory QA/QC Coordinator

Date: 10/6/14

L Basterrechea
Leslea Basterrechea, Laboratory QA/QC Coordinator

Date: 10/6/14

Erica Anderson Maguire, ACHD Stormwater Quality Supervisor

Date: 10/8/14

Monica Lowe
Digitally signed by Monica Lowe
DN: cn=Monica Lowe, o, ou, email=mlowe@achdidaho.org, c=US
Date: 2014.10.08 09:27:52 -06'00'

Monica Lowe, ACHD Stormwater Quality Coordinator

Date: _____

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A3. Distribution List

Boise City Public Works Dept

Operations Division

1. Janet Finegan-Kelly, Water Quality Lab Manager
2. Karen Griffin, Laboratory QA/QC Coordinator
3. Leslea Basterrechea, Laboratory QA/QC Coordinator
4. Water Quality Lab

Ada County Highway District

1. Monica Lowe, Storm Water Quality Coordinator
2. Erica Anderson Maguire, Stormwater Quality Supervisor

A3a. Abbreviations

ACHD	Ada County Highway District
ACS	American Chemical Society
ASAP	As Soon as Possible
CFR	Code of Federal Regulations
COC	Chain of Custody
DQO	Data Quality Objective
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
IDL	Instrument Detection Level
LCS	Laboratory Control Standard
LIMS	Laboratory Information Management System
MDL	Method Detection Level
ML	Minimum Level
NIST	National Institute for Standards and Technology
NPDES	National Pollutant Discharge Elimination System
OJT	On-the-job Training
QA	Quality Assurance
QAP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
WQLAB	Water Quality Laboratory

A4 Project /Task Organization

Boise City's Water Quality Laboratory located at 11818 Joplin Road in Boise, Idaho, 83714 (Ph 208/608-7240) will be teaming with ACHD staff and their associates, to meet many of the compliance monitoring requirements in NPDES permit IDS-02756-1.

The responsibilities of the Water Quality Laboratory will be to prepare sampling containers; receive, split and store samples; analyze samples for specified parameters using methods approved for NPDES compliance; report analytical and quality assurance data to Ada County Highway District (ACHD) staff; properly dispose of samples; hold all original documentation on-site for a minimum of 2 years; archive the documentation for additional 10 years.

The focus of this QAPP is to describe the protocols, methods and procedures to be used by the Water Quality Laboratory to meet the requirements listed at Sections IV.2.a. (4) and IV.2.b. of NPDES permit IDS-02756-1.

The management of the laboratory's Quality Control Program as described in this manual requires the services of two QA/QC Coordinators within the laboratory to carry out the monitoring, record-keeping, statistical techniques, calibration, and other functions required by the system. Additionally, senior technical personnel within the laboratory, with the job title of Water Quality Lab Analyst, assist the QA/QC Coordinators' efforts in highly specialized areas such as inorganic chemistries or microbiology. The QA/QC Coordinators of Water Quality Lab report to the Laboratory Manager. Please see the Public Works Organizational chart in Appendix A.

Boise City job descriptions of lab staff involved with the permit plus the names of individuals currently in those positions are found at Appendices B and C.

A5 Problem Definition/Background

The purpose of the Quality Assurance Program Plan (QAPP) is to document compliance plans for operations and to provide a project-specific "blueprint" for obtaining the type and quality of data needed for a specific decision or use. The QAPP documents how quality assurance (QA) and quality control (QC) are applied to an environmental data operation to assure that the results obtained are of the type and quality needed and expected.

This Quality Assurance Program Plan (QAPP) applies to all data generated for compliance to requirements contained in NPDES permit IDS-02756-1. This document complements the *Water Quality Laboratory Quality Assurance Manual*, Boise City Public Works Dept, rev. 2014 *et seq.* This manual contains the specific details, often in SOP format, of how the laboratory structures its quality system, defines and assigns QA and QC responsibilities, and describes the processes and procedures used to plan, implement, and assess the effectiveness of the quality system. The Quality Assurance manual is the "umbrella" under which individual projects are conducted.

The QAPP is to be revised as needed to be kept current. The review and approval process is to be the same for revisions as the original plan. At a minimum, annual review by the Program Coordinators is required. The Program Coordinators for this QAPP are the Boise City's Water Quality Lab Manager and ACHD's Storm Water Quality Specialist.

A6. Project/Task Organization and Schedule

The sampling and testing regiment is designed to meet the requirements of the NPDES permit IDS-02756-1. Boise's Water Quality Lab is open Monday through Saturday and staffed from 7 am to 3:30 pm. ACHD staff coordinates sample collection; however notification of Water Quality Lab staff before leaving to sample is advised. The Lab Manager or her designee may call in additional staff after hours or on Sunday s as needed to split, filter, preserve, set up or analyze samples to meet sample holding times and analytical requirements. The lab staff will prioritize analyses to meet holding times but in some cases such as bacteria samples with an 8 hr holding time, it may be impossible if bacteria samples are submitted in the early evening. If a sample does not get set up within holding time, or does not meet method criteria, a qualifier will be attached to the data result along with a comment as to the conditions that were not met. In anticipation of an impending stormwater event ACHD staff may submit "dry" pre-storm samples which will be set up by lab staff regardless if the matching storm sample is submitted to optimize meeting the analytical holding time. It is at ACHD's discretion to request lab QC split samples and submit field QC.

The laboratory software system contains a "sample scheduler" module in which the QA/QC Coordinator or their designee has pre-loaded the sample locations and requested tests. ACHD staff will have 24-hour access to the lab's sample storage area, and a secure refrigerator

There are different types of sampling events: Phase 1 , Phase 2, Dry Weather Outfall Screening (DWOS). The descriptions are listed below.

NPDES Phase 1 Monitoring of discharges from municipal separate storm sewer systems (MS4s)

Sample Site	Location Code	E. coli * (Cl screen)	Ammonia	TKN	NOx	DRP	BOD	COD	TSS	TDS	Total As,Cd,,Pb,P, hardness	Hg	Dissolved Cd, Cu, Pb,Zn	Turbidity
Americana	ACHDA		x	x	x	x	x	x	x	x	x	x	x	x
"dry" grab	ACHDAD	x	x	x	x	x	x	x	x	x	x	x	x	x
grab	ACHDG	x												
Lucky	ACHDL		x	x	x	x	x	x	x	x	x	x	x	x
"dry" grab	ACHDLD	x	x	x	x	x	x	x	x	x	x	x	x	x
grab	ACHDLG	x												
Main	ACHDM		x	x	x	x	x	x	x	x	x	x	x	x
"dry" grab	ACHDMD	x	x	x	x	x	x	x	x	x	x	x	x	x
grab	ACHDMG	x												
Stilson	ACHDS		x	x	x	x	x	x	x	x	x	x	x	x
"dry" grab	ACHDSD	x	x	x	x	x	x	x	x	x	x	x	x	x
grab	ACHDSG	x												
Whitewater	ACHDWW		x	x	x	x	x	x	x	x	x	x	x	x
"dry" grab	ACHDWWD	x	x	x	x	x	x	x	x	x	x	x	x	x
grab	ACHDWWG	x												

- E. coli* Chlorine screen done on all bacteria samples prior to setting sample up.

Phase II Monitoring of a stormwater outfall to the Boise River or a tributary to the Boise River that is not already covered by a NPDES permit.

Sample Site	Location code	E. coli * (Cl screen)	TSS	TP	TKN	NOx	DRP**
Edgwood	ACHD2EW	x	x	x	x	x	x
"dry" grab	ACHD2ED	x	x	x	x	x	x
Christfield	ACHD2CW	x	x	x	x	x	x
"dry" grab	ACHD2CD	x	x	x	x	x	x
Chrisfield Instream	ACHDCFI	x	x	x	x	x	x

- E.coli* Chlorine screen done on all bacteria samples prior to setting sample up.
- DRP** Dissolved phosphorous not required in NPDES permit but requested by ACHD.

Dry Weather Outfall Screening sites vary but are grab samples, an example would be 5-10 mile sampling and synoptic sampling

Sample Site	Location code	E. coli	TSS	TP	DRP		
05-16.36C	ACFTE36	x	x	x	x		
05-8.16C	ACFTM16	x	x	x	x		
10-8.72C	ACFTM72	x	x	x	x		
10-16.07C	ACFTW07	x	x	x	x		
10-17.05C	ACHDSP**	x	x	x	x		

- E.coli* Chlorine screen done on all bacteria samples prior to setting sample up.
- ACHDSP**: ACHD Special is a generic sample location for sampling sites that are unique and may not be repeated or need to have their data history tracked in LIMS.

A7. Data Quality Objectives and Criteria for Measuring Data

In order to ensure quality readings, samples for each test are broken up into sample sets. Ideally, each sample set contains no more than ten samples, has a replicate of one of the samples along with a matrix spike and method blank. The sets usually contain additional measurements such as fortified blanks and lab control standards. Depending on the complexity of the analytical instrumentation initial and continuing calibration blanks (ICB and CCBs), initial and continuing calibration verification standards (ICV and CCVs) tuning standards and interference check standards may be required to validate the optimization , calibration and stability of the instrumentation. This is often specified in the method. Whenever feasible, a certified reference standard traceable to NIST is used. The individual sample set requirements for each test are stated in that test's SOP.

There are individual data quality objectives, DQOs, for each test done in the laboratory. These QC objectives are either method defined or derived by evaluating and assigning acceptance ranges based on the criteria defined in the Alternate Test Procedure (ATP) approval guidance listed in 40 CFR part136. The QC criteria is usually acceptance ranges for parameters such as initial calibration verification (ICV) and continuing calibration verification(CCV) standards, blank, relative percent difference (RPD), lab fortified matrix (LFM) or matrix spike (MS)and matrix spike duplicate (MSD) percent spike recovery, and lab fortified blank spike (LFB). The lab has been using control charts for the last 15-20 years and had experienced that the acceptance ranges had become increasingly tighter each year due to the fact that only passing data was charted. The extremely tight acceptance ranges required many un-necessary re-analyses. The decision to use the QC acceptance ranges specified for ATP approval as guidance for determining our acceptance criteria was just implemented in January 2014, based on the premise that the acceptance criteria stated was standardized, and used to determine method acceptance by the EPA. The acceptance ranges specified by our lab are in most cases tighter than those

recommended by the ATP process or standardized across methods to establish convention within similar methods. These QA/QC control ranges are defined in each Method SOP and an updated chart will be included in the Quality Assurance manual. The QC data is entered into LIMS and the values charted, if a bias is seen in the QC parameter that the method reagents or instruments will be investigated. If this does happen, however, additional maintenance and trouble shooting of the equipment can be done to bring the results back inside the control limits. The responsibility for the troubleshooting is shared by the lab analysts, technicians and the QA/QC Coordinators. To demonstrate initial proficiency of technique, and periodically on going proficiency checks. An Initial Precision and Recovery (IPR) exercise is performed on a standard where 4 aliquots of a standard are brought the entire method and the precision and recovery of the results are measured against a predetermined metric for each method as recommended in the ATP guidance and Standard Methods for the Examination of Water and Wastewater 22 edition.

Detection limit is the smallest value that can be detected above the background noise of a procedure. For this laboratory the method detection level (MDL) is the detection limit to be used when quantifying data (unless another value is dictated by method.) The MDL is defined as the analyte concentration that, when processed through the complete procedure being evaluated, produces a value with a 99% probability that it is different from a blank. The only exception to this is that MDLs for dissolved parameters are not spiked before filtration-due to the interpretation from the EPA that the sample is not created until it has been filtered.

In accordance with 40 CFR 136 Appendix B, the MDL is determined using the following method: If the lab has no previous MDL, several aliquots of a sample of the same matrix as the calibration curve are analyzed to determine the approximate value of the MDL. A single source solution of the same matrix as the calibration curve is prepared with a concentration above the MDL, but not more than ten times the MDL. A minimum of seven aliquots of the prepared solution are digested or extracted if needed and analyzed with each aliquot being treated as an individual sample. The QA/QC (slopes, LCS, blanks, calibration curves, correlation coefficients, MDL standard recoveries, etc.) of the analytical run must be acceptable. Once all of the data for the aliquots has been collected, the standard deviation is multiplied by the appropriate students' T test value depending on number of replicates used and the MDL is determined. If this is a confirmation, the new MDL is determined using a pooled standard deviation from both the new and the old data. The MDL standard deviation is used to determine the number of decimals for the MDL value. If there is a blank that is not part of the calibration curve, the MDL should not be lower than the blank. A review of blank history in LIMS is done to assure that the assigned MDL value can distinguish a valid detection from background noise. The MDL should be re-determined yearly unless there is a change in procedure, for which a new MDL should be calculated earlier. Reported MDLs are adjusted for sample dilutions and/or percent solids if applicable. Revisions are made and updated copies are posted by the QA/QC Coordinator as necessary. The most current MDL list is found online at I:Lab:QAQC:MDL : WQLABMDLS.

Charts are located throughout the laboratory which denote the MDL, control limit values, and significant figures for each test. These charts are used as a reference by the laboratory

technicians during testing and data entry. Revisions are made and updated copies are posted by the QA/QC Coordinator as necessary.

The Minimum Level (ML) is defined as "The concentration at which the entire method analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes and processing steps have been followed." The ML is often defined in performance based methods and is 3.18 times the method specified MDL. The Boise City wastewater NPDES permits have mandated ML requirements whereas the stormwater MS4 NPDES permit does not. Some EPA methods mandate the use of MDL and ML when reporting results, such as EPA methods 1664B and 1631E. The Boise City WQLAB will only apply MLs where the methods mandate their use.

A8. Training Requirements/Certification

Quality Control training programs will have objectives seeking solutions to laboratory quality problems. These training objectives will help to develop for all laboratory personnel involved in any aspect or function affecting quality, those attitudes, that knowledge, and those skills which will enable each one to contribute to the production of high quality data continuously and effectively. All personnel involved in any function affecting data quality (sample collection, analysis, testing, data reduction, and quality control and assurance) will have sufficient training in their appointed positions to contribute to the reporting of complete, high quality data. The QA/QC Coordinators, Wet Chemistry Lab Supervisor and Lab Manager share the responsibility that the required training is available to these personnel and that records are maintained on each person reflecting satisfactory completion of training programs or qualification tests.

Employees are given a copy of the training outline and documentation forms to be used in the laboratory. They read regulatory permits, safety manuals, the QA manual, and view webinars. The first day an employee is on site, the safety check list is reviewed with the location and use of safety equipment (personal and workplace). Employees are then required to read the SOPs for the analysis and equipment they will use for a specific test. A trainer signs off that a specific SOP was read. They then observe an experienced technician perform the different tasks in the measurement process. When comfortable with the entire procedure, employees perform the test under the direct supervision of an experienced technician. Employees then perform the tests independently but with a high level of supervision. The employee then asks the trainer to sign off the "hands-on" training for that specific test.

After an employee feels confident they have mastered the routine operation, equipment maintenance and troubleshooting of a procedure, they approach the QA/QC Coordinator and request a blind proficiency sample or perform an Initial Precision and Recovery (IPR) on a standard specified by the QA/QC Coordinator. If the results are acceptable the employee can set-up an "oral quiz." The QA/QC Coordinator determines if subject mastery has been reached and will then sign off on the proficiency check for that specific analysis. Until an employee has been

signed off as proficient on a given test, they are unable to train others and their work is subject to intense review.

During the annual employee performance review with the Lab Manager, the previous year's training outline and documentation forms are discussed. Any gaps in the training and/or documentation are identified and an action plan discussed. A copy of the training outline and documentation forms to be used the upcoming year is then given to the employee. The original training outline and documentation forms are filed by the QA/QC Coordinator and kept on-site in the lab for 10 years.

Continued discussion and refinement of techniques and analytical methods are discussed at lab staff meetings. Discussions and decisions are documented in written meeting minutes which are dispensed to all lab employees. These minutes are used during SOP revisions to help keep the written methods up to date.

Independent study: Reference materials, certification study guides, webinars and occupational literature are available for review by lab personnel. Required and leisure reading is routed to all lab staff and placed in a read basket called the "ASAP" file. Additionally, night school classes, outside reading, subject research on the internet, attendance at seminars, or professional society meetings, etc. on a voluntary basis are encouraged. Employees may consult the Laboratory Manager for information on tuition and fee payments by the City. In-house training is class room study, held during working hours, presented on a formal basis. Courses may be given by qualified City personnel or outside instructors. Equipment training by vendors is provided when new pieces of equipment and instrumentation are purchased; an attempt is made to have the vendor provide training to as many lab staff as feasible. Additionally when complex instrumentation is to be purchased, applicable employees will attend vendor presentations and demonstrations if applicable and research various vendor instrumentation to identify the key components required to best meet the City's needs. Training documents, instrumentation and maintenance manuals and instructions, and in-house SOPs for operation and maintenance are available to all staff.

State wastewater/water operator and laboratory licenses: As of April 15, 2006, the State of Idaho has a mandatory licensure requirement. Employees are expected to achieve State wastewater certification in Wastewater Operations I and Wastewater Laboratory I immediately after minimum tenure requirements are met. An "operator in training" license is available for those persons with less than a year's experience at a POTW. Water Quality Lab Analysts and the QA/QC Coordinator should achieve a Wastewater Operations II and WW Laboratory III certificate within 3 years of hire to that position or when eligibility requirements are met. To maintain the WW lab and WW Operator training licenses the employee must attain 0.6 continuing education units (CEUs) per year where 0.1 CEU is equivalent to 1 hour of training.. All courses used for CEUs must be pre-approved by the Idaho Bureau of Licensure (IBOL) to prove applicability to the license discipline. Copies of the employee's CEU certificates are maintained in the office of the Laboratory. CEU courses are supplied by various groups within

the Operations division at least quarterly as well as by professional trade groups such as Idaho Rural Water Association and South Western Idaho Operators Section as well as Training Consultants.

A9. Documentation and Records

Hard copy bench sheets or instrument print outs are created for all tests. On these sheets, a combination of at least 2 of the following identifiers: the samples' unique LIMS number, sample location/name, and sample date are denoted. Additionally, calibration, quality assurance measures, dilutions, analysis, analyst, test date and time, new reagents and analytical results are denoted. Comments pertaining to the specific test or to the sample are denoted as well.

After test completion and verification that test parameters meet quality assurance acceptance criteria, the analytical and QC results are entered into the lab's laboratory information management system (LIMS) and the technician initials and dates the bench sheet. The bench sheet is then given to the QA/QC Coordinator for review. If the documentation is complete, the QA/QC Coordinator signs the sheet and places the bench sheet or data package in the designated file organizer in the data entry room or Metals' lab for data entry review and validation by lab staff. The bench sheet/ data package is returned for filing. See Section B.10 of this document for further details of data management.

If NPDES compliance samples or data are rejected, detailed explanations will given on the sample analysis report or on an attached cover letter which are provided to ACHD.

In addition to bench sheets and instrument printouts, other forms of documentation are kept in the laboratory. These include instrument temperature logs, instrument maintenance logs, reagent logs, balance calibration logs, sample chain-of-custody forms, etc. In all cases, the date, analyst, and actions are logged.

Prior to 2006: after three years, the above documents were inventoried and archived according to procedures set forth in Boise City Public Works Department "Records Management Program", rev. 2/00 *et seq.* These documents are retained in the City archives for a minimum of 10 more years.

In 2006 archiving of new hard copy documents was discontinued by City policy. Lab documents archived in 2006 and subsequent years will be kept in a secure location in the West Boise "old pretreatment" building for a minimum or 10 years. This archiving will be the responsibility of the Water Quality Laboratory Manager.

B1 Sampling Process Design

The sampling schedule and tests described in section A6 will be used to meet the requirements of the NPDES permit and assist ACHD and other storm water co-permittees. The testing schedule is designed to leave time for reruns as needed or requested and meet holding times for the samples. Changes are made at the discretion of the QA/QC Coordinator and/or the Laboratory Manager.

B2. Sampling Methods Requirements

The type of sample matrix (solid, aqueous, etc) determines the method of sampling and the type of container used to collect the sample and the tests being performed on the sample. These requirements are contained within the QA manual and in the SOPs for each test. In the absence of direction, Table II Required Containers, Preservation, Techniques and Holding times in 40 CFR 136 is the primary reference for NPDES compliance a screen shot of table II is included for reference. If more information is needed then Table 1060: I Summary of Special Sampling or Handling Requirements found in the most recently approved edition of *Standard Methods for the Examination of Water and Wastewater* is used . For some solid matrices, and for 503 regulatory compliance *Test Methods for Evaluating Solid Waste, Physical /Chemical Methods* known as SW-846 is used.

The type of samples (e.g., solid or aqueous), and the equipment, materials, and special techniques necessary to gather them (e.g., pumps, filters, containers, "clean chemistry") are described in the QA manual or test SOP. In addition, any procedures to clean or decontaminate equipment prior to or during sample collection to prevent contamination of existing samples, or in order to prepare for the next sampling, are also defined by SOP. Analytical method minimum volumes, number of specimens, preservatives, and holding times and conditions (e.g., temperature control) are described in the QA manual as well.

provided to assure such changes in sample preservation, containers or holding times do not adversely affect the integrity of the sample. The Regional ATP Coordinator or permitting authority will review the application and then notify the applicant and the appropriate State agency of approval or rejection of the use of the alternate test procedure. A decision to approve or deny any request on deviations from the prescribed Table II requirements will be made within 90 days of receipt of the application by the Regional Administrator. An analyst may not modify any sample preservation and/or holding time requirements of an approved method unless the requirements of this section are met.

TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter number/name	Container [1]	Preservation [2,3]	Maximum holding time [4]
Table IA—Bacterial Tests:			
1–5. Coliform, total, fecal, and *E. coli*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22,23]
6. Fecal streptococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
7. Enterococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
8. *Salmonella*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
Table IA—Aquatic Toxicity Tests:			
9–12. Toxicity, acute and chronic	P, FP, G	Cool, ≤6 °C [16]	36 hours.
Table IB—Inorganic Tests:			
1. Acidity	P, FP, G	Cool, ≤6 °C [18]	14 days.
2. Alkalinity	P, FP, G	Cool, ≤6 °C [18]	14 days.
4. Ammonia	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
9. Biochemical oxygen demand	P, FP, G	Cool, ≤6 °C [18]	48 hours.
10. Boron	P, FP, or Quartz	HNO_3 to pH <2	6 months.
11. Bromide	P, FP, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous	P, FP G	Cool, ≤6 °C [18]	48 hours.
15. Chemical oxygen demand	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
16. Chloride	P, FP, G	None required	28 days.
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes.
21. Color	P, FP, G	Cool, ≤6 °C [18]	48 hours.
23–24. Cyanide, total or available (or CATC) and free.	P, FP, G	Cool, ≤6 °C [18], NaOH to pH >10 [13,6], reducing agent if oxidizer present.	14 days.
25. Fluoride	P	None required	28 days.
27. Hardness	P, FP, G	HNO_3 or H_2SO_4 to pH <2	6 months.
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes.
31, 43. Kjeldahl and organic N	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
Table IB—Metals: [7]			
18. Chromium VI	P, FP, G	Cool, ≤6 °C [18], pH = 9.3–9.7 [20].	28 days.
35. Mercury (CVAA)	P, FP, G	HNO_3 to pH <2	28 days.
35. Mercury (CVAFS)	FP, G; and FP-lined cap [17]	5 mL/L 12N HCl or 5 mL/L BrCl [17].	90 days.[17]
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO_3 to pH <2, or at least 24 hours prior to analysis [19].	6 months.
38. Nitrate	P, FP, G	Cool, ≤6 °C [18]	48 hours.
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
40. Nitrite	P, FP, G	Cool, ≤6 °C [18]	48 hours.
41. Oil and grease	G	Cool to ≤6 °C [18], HCl or H_2SO_4 to pH <2.	28 days.
42. Organic Carbon	P, FP, G	Cool to ≤6 °C [18], HCl, H_2SO_4, or H_3PO_4 to pH <2.	28 days.
44. Orthophosphate	P, FP, G	Cool, to ≤6 °C [18,24]	Filter within 15 minutes; Analyze within 48 hours.
46. Oxygen, Dissolved Probe	G, Bottle and top	None required	Analyze within 15 minutes.
47. Winkler	G, Bottle and top	Fix on site and store in dark.	8 hours.
48. Phenols	G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
49. Phosphorous (elemental)	G	Cool, ≤6 °C [18]	48 hours.
50. Phosphorous, total	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
53. Residue, total	P, FP, G	Cool, ≤6 °C [18]	7 days.
54. Residue, Filterable	P, FP, G	Cool, ≤6 °C [18]	7 days.

TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES—Continued

Parameter number/name	Container[1]	Preservation[2,3]	Maximum holding time[4]
55. Residue, Nonfilterable (TSS)	P, FP, G	Cool, ≤6 °C[18]	7 days.
56. Residue, Settleable	P, FP, G	Cool, ≤6 °C[18]	48 hours.
57. Residue, Volatile	P, FP, G	Cool, ≤6 °C[18]	7 days.
61. Silica	P or Quartz	Cool, ≤6 °C[18]	28 days.
64. Specific conductance	P, FP, G	Cool, ≤6 °C[18]	28 days.
65. Sulfate	P, FP, G	Cool, ≤6 °C[18]	28 days.
66. Sulfide	P, FP, G	Cool, ≤6 °C[18], add zinc acetate plus sodium hydroxide to pH >9.	7 days.
67. Sulfite	P, FP, G	None required	Analyze within 15 minutes.
68. Surfactants	P, FP, G	Cool, ≤6 °C[18]	48 hours.
69. Temperature	P, FP, G	None required	Analyze.
73. Turbidity	P, FP, G	Cool, ≤6 °C[18]	48 hours.
Table IC—Organic Tests:[8]			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 76, 104, 105, 108–111, 113. Purgeable Halocarbons.	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5].	14 days.
6, 57, 106. Purgeable aromatic hydrocarbons	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5], HCl to pH 2[9].	14 days.[9]
3, 4. Acrolein and acrylonitrile	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$, pH to 4–5[10].	14 days.[10]
23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112. Phenols[11].	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$.	7 days until extraction, 40 days after extraction.
7, 38. Benzidines[11,12]	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5].	7 days until extraction.[13]
14, 17, 48, 50–52. Phthalate esters[11]	G, FP-lined cap	Cool, ≤6 °C[18]	7 days until extraction, 40 days after extraction.
82–84. Nitrosamines[11,14]	G, FP-lined cap	Cool, ≤6 °C[18], store in dark, 0.008% $Na_2S_2O_3$[5].	7 days until extraction, 40 days after extraction.
86–94. PCBs[11]	G, FP-lined cap	Cool, ≤6 °C[18]	1 year until extraction, 1 year after extraction.
54, 55, 75, 79. Nitroaromatics and isophorone[11]	G, FP-lined cap	Cool, ≤6 °C[18], store in dark, 0.008% $Na_2S_2O_3$[5].	7 days until extraction, 40 days after extraction.
1, 2, 5, 8–12, 32, 33, 58, 59, 74, 78, 99, 101. Polynuclear aromatic hydrocarbons[11].	G, FP-lined cap	Cool, ≤6 °C[18], store in dark, 0.008% $Na_2S_2O_3$[5].	7 days until extraction, 40 days after extraction.
15, 16, 21, 31, 87. Haloethers[11]	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5].	7 days until extraction, 40 days after extraction.
29, 35–37, 63–65, 107. Chlorinated hydrocarbons[11].	G, FP-lined cap	Cool, ≤6 °C[18]	7 days until extraction, 40 days after extraction.
60–62, 66–72, 85, 86, 95–97, 102, 103. CDDs/CDFs[11].			
Aqueous Samples: Field and Lab Preservation	G	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5], pH <9.	1 year.
Solids and Mixed-Phase Samples: Field Preservation.	G	Cool, ≤6 °C[18]	7 days.
Tissue Samples: Field Preservation	G	Cool, ≤6 °C[18]	24 hours.
Solids, Mixed-Phase, and Tissue Samples: Lab Preservation.	G	Freeze, ≤ −10 °C	1 year.
114–118. Alkylated phenols	G	Cool, <6 °C, H_2SO_4 to pH <2.	28 days until extraction, 40 days after extraction.
119. Adsorbable Organic Halides (AOX)	G	Cool, <6 °C, 0.008% $Na_2S_2O_3$ HNO_3 to pH <2.	Hold *at least* 3 days, but not more than 6 months.
120. Chlorinated Phenolics		Cool, <6 °C, 0.008% $Na_2S_2O_3$ H_2SO_4 to pH <2.	30 days until acetylation, 30 days after acetylation.
Table ID—Pesticides Tests:			
1–70. Pesticides[11]	G, FP-lined cap	Cool, ≤6 °C[18], pH 5–9[15]	7 days until extraction, 40 days after extraction.
Table IE—Radiological Tests:			
1–5. Alpha, beta, and radium	P, FP, G	HNO_3 to pH <2	6 months.
Table IH—Bacterial Tests:			
1. *E. coli*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5].	8 hours.[22]
2. Enterococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5].	8 hours.[22]
Table IH—Protozoan Tests:			
8. *Cryptosporidium*	LDPE; field filtration	1–10 °C	96 hours.[21]
9. *Giardia*	LDPE; field filtration	1–10 °C	96 hours.[21]

[1] "P" is for polyethylene; "FP" is fluoropolymer (polytetrafluoroethylene (PTFE); Teflon®), or other fluoropolymer, unless stated otherwise in this Table II; "G" is glass; "PA" is any plastic that is made of a sterilizable material (polypropylene or other autoclavable plastic); "LDPE" is low density polyethylene.

[2] Except where noted in this Table II and the method for the parameter, preserve each grab sample within 15 minutes of collection. For a composite sample collected with an automated sample (*e.g.*, using a 24-hour composite sample; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), refrigerate the sample at ≤ 6 °C during collection unless specified otherwise in this Table II or in the method(s). For a composite sample to be split into separate aliquots for preservation and/or analysis, maintain the sample at ≤ 6 °C, unless specified otherwise in this Table II or in the method(s), until collection, splitting, and preservation is completed. Add the preservative to the sample container prior to sample collection when the preservative will not compromise the integrity of a grab sample, a composite sample, or aliquot split from a composite sample within 15 minutes of collection. If a composite measurement is required but a composite sample would compromise sample integrity, individual grab samples must be collected at prescribed time intervals (*e.g.*, 4 samples over the course of a day, at 6-hour intervals). Grab samples must be analyzed separately and the concentrations averaged. Alternatively, grab samples may be collected in the field and composited in the laboratory if the compositing procedure produces results equivalent to results produced by arithmetic averaging of results of analysis of individual grab samples. For examples of laboratory compositing procedures, see EPA Method 1664 Rev. A (oil and grease) and the procedures at 40 CFR 141.34(f)(14)(iv) and (v) (volatile organics).

[3] When any sample is to be shipped by common carrier or sent via the U.S. Postal Service, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirement of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater; Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before the start of analysis and still be considered valid. Samples may be held for longer periods only if the permittee or monitoring laboratory has data on file to show that, for the specific types of samples under study, the analytes are stable for the longer time, and has received a variance from the Regional Administrator under Sec. 136.3(e). For a grab sample, the holding time begins at the time of collection. For a composite sample collected with an automated sampler (*e.g.*, using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR part 403, Appendix E), the holding time begins at the time of the end of collection of the composite sample. For a set of grab samples composited in the field or laboratory, the holding time begins at the time of collection of the last grab sample in the set. Some samples may not be stable for the maximum time period given in the table. A permittee or monitoring laboratory is obligated to hold the sample for a shorter time if it knows that a shorter time is necessary to maintain sample stability. See 136.3(e) for details. The date and time of collection of an individual grab sample is the date and time at which the sample is collected. For a set of grab samples to be composited, and that are all collected on the same calendar date, the date of collection is the date on which the samples are collected. For a set of grab samples to be composited, and that are collected across two calendar dates, the date of collection is the dates of the two days; *e.g.*, November 14–15. For a composite sample collected automatically on a given date, the date of collection is the date on which the sample is collected. For a composite sample collected automatically, and that is collected across two calendar dates, the date of collection is the dates of the two days; *e.g.*, November 14–15. For static-renewal toxicity tests, each grab or composite sample may also be used to prepare test solutions for renewal at 24 h, 48 h, and/or 72 h after first use, if stored at 0–6 °C, with minimum head space.

[5] ASTM D7365–09a specifies treatment options for samples containing oxidants (e.g., chlorine). Also, Section 9060A of Standard Methods for the Examination of Water and Wastewater (20th and 21st editions) addresses dechlorination procedures.

[6] Sampling, preservation and mitigating interferences in water samples for analysis of cyanide are described in ASTM D7365–09a. There may be interferences that are not mitigated by the analytical test methods or D7365–09a. Any technique for removal or suppression of interference may be employed, provided the laboratory demonstrates that it more accurately measures cyanide through quality control measures described in the analytical test method. Any removal or suppression technique not described in D7365–09a or the analytical test method must be documented along with supporting data.

[7] For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler (*e.g.*, using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), filter the sample within 15 minutes after completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (*e.g.*, by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] If the sample is not adjusted to pH 2, then the sample must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity (*i.e.*, use all necessary preservatives and hold for the shortest time listed). When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 12, 13 (regarding the analysis of benzidine).

[12] If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 30 days at < 0 °C.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[16] Place sufficient ice with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature. Aqueous samples must not be frozen. Hand-delivered samples used on the day of collection do not need to be cooled to 0 to 6 °C prior to test initiation.

[17] Samples collected for the determination of trace level mercury (<100 ng/L) using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

[18] Aqueous samples must be preserved at ≤ 6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of "≤ °C" is used in place of the "4 °C" and "< 4 °C" sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures (1/100th of 1 degree); rather, three significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[19] An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this footnote supersede the preservation and holding time requirements in the approved metals methods.

[20] To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium methods, unless this supersession would compromise the measurement, in which case requirements in the method must be followed.

[21] Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field.

[22] Sample analysis should begin as soon as possible after receipt; sample incubation must be started no later than 8 hours from time of collection.

[23] For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB–EC) or 1681 (A–1): Class A composted, Class B aerobically digested, and Class B anaerobically digested.

[24] The immediate filtration requirement in orthophosphate measurement is to assess the dissolved or bio-available form of orthophosphorus (*i.e.*, that which passes through a 0.45-micron filter), hence the requirement to filter the sample immediately upon collection (*i.e.*, within 15 minutes of collection).

Sample/ Bottle Preparation in Water Quality Lab

Parameter	Sample type	Sample Volume	Bottle size/type	Preservation	Special bottle prep	notes
E.coli	grab	500 ml	500 ml polypropylene		autoclave	
Ammonia/ TKN	24 hr comp	1L	1L HDPE	< pH 2 H_2SO_4		
Ammonia	grab-comp	500 ml	500 ml disposable pre-cleaned HDPE	< pH 2 H_2SO_4		Low level 10 ug/L ML
BOD	24 hr comp/ grab- comp	1 L	1L HDPE or glass beaker			
TSS	24 hr comp/ grab- comp	2- 3 L	4L HDPE			Run in duplicate
Total Phos	24 hr comp/ grab- comp	500 ml	500 ml disposable HDPE bottle	<pH 2 HNO_3		.
Total Phos	24 hr comp/ grab- comp	500 ml	500ml teflon	<pH 2 HNO_3	Radiac wash	
Total metals- hardness	24 hr comp/ grab- comp	500 ml	500 ml teflon	<pH 2 HNO_3	Radiac wash	
Dissolved metals	grab-comp	500 ml	500 ml teflon	<pH 2 HNO_3	Radiac wash	Filter first with Voss PES 0.45um cartridge filter waste 1800 ml
Mercury	24 hr comp/ grab- comp	200 ml	200-400 ml glass	1%BrCl until sample remains yellow	Radiac wash	Low level MDL= 0.2ng/L
Mercury	24 hr comp	500 ml	500 ml teflon	<pH 2 HNO_3	Radiac wash	MDL = 5.0 ng/L
Cyanide	grab	1 L	1L HDPE	pH 10-11 NaOH		Screen for interferences before pres.
Cyanide	8 grab- composite	8 x 1L	1 L HDPE	pH 10-11 NaOH		Screen each for interferences before pres.
Nitrate-Nitrite	24 hr comp/ grab- comp	500 ml	500 ml HDPE	< pH 2 H_2SO_4		Filter first PES 0.45um

Total Organic Carbon	24 hr comp/ grab- comp	250 ml	250 ml amber glass	< pH 2 H_3PO4	Baked at 400 °C lids at 104 °C	
Alkalinity	24 hr comp/ grab- comp	125 ml	125 ml HDPE			
O&G	grab	1 L	2 L glass	pH 2	Hexane rinsed	Collected in triplicate
Turbidity	24 hr comp/ grab- comp	200 ml	200 ml HDPE			
WET	24 hr comp	4 L	cubitainer			
BNA	24 hr comp	1 L	Amber glass			Collected in duplicate
Pesticides	24 hr comp	1 L	1L Amber glass			Collected in duplicate
VOC	grab	40 ml	40 ml vials		Zero headspace	Collected in triplicate

B3. Sample Handling and Custody Requirements

The chain-of-custody is necessary to ensure sample integrity from the time of sample collection through data reporting. This includes the ability to trace possession and handling of the sample from the time of collection through analysis. Sample labels are essential to prevent misidentification of samples and include place of collection, date and time of collection and collector. Sample seals may be used to ensure that samples are not tampered with up to and after sample analysis and to confirm that specific requirements were fulfilled by the collector at the time of collection.

Log books and the chain-of-custody forms are also used as a means of tracking samples. The field log book is a record of all information taken during a field sampling event and may include the location of the sampling point, date and time of collection, weather conditions, any unusual circumstance that may affect the results of the collected sample, as well as any other information needed for the specific sampling method used. The chain-of-custody accompanies each sample or group of samples and includes the agency of the sample, who it was delivered by, the delivery date and time, sample identification, the time and date the sample was set up and taken off, pertinent comments, who received the sample, the date and time of its receipt, and what analytes to test for. A sample temperature may be taken, or additional analytes added and recorded on the COC if the sample delivery was delayed or if the Lab suspects that the sample may have been compromised. In addition any information or comments on the COC will be added in the Laboratory Information Management System (LIMS) in sample comments. A COC is also used to accompany specific samples to outside laboratories for conducting specified tests. This form includes the sample name, an ID number, date of sample collection and receipt, and analyses to be performed.

Upon delivery of a sample the sample custodian (colloquially referred to as the Sample Maitre'D) receives the sample, completes the receiving end of the chain-of-custody, assigns a unique LIMS number to each sample, and logs in all analyses to be conducted on the sample. The sample custodian prints labels which are placed on the samples and splits off portions of the sample that are not immediately being analyzed. The LIMS label generated has the sample location, date and unique LIMS number. These aliquots are pH tested if required and the then preserved. Additionally, the sample is marked with tape or a colored dot to denote that the sample has been filtered and/or preserved. Samples for metals' analyses are delivered to the Metals lab where samples are logged in and the amount of acid needed for preservation/ sample volume is recorded. If samples for metals are preserved within 15 minutes, they can be analyzed immediately. If preserved later, the samples have to sit 24 hours until analysis. The pH is rechecked and verified to be <pH 2 although this is no longer required by 40 CFR 136. After receipt by the laboratory, samples are held in a secure location before and after testing. This is often a locked sample refrigerator located in a locked lab. Samples exceeding compliance limits (NPDES permit or local Pretreatment ordinance) are secured with custody seals and stored within a locked refrigerator within the locked lab building. Only laboratory staff knows the location of the key for this locked refrigerator.

B4. Analytical Methods Requirements

The QA manual contains the SOPs for each test and is based upon standard referenced methods as relevant to the specific project. Field measurements are taken in a similar way to those in the laboratory. Modifications to standard methods must be justified, including discussion of sample preparation (extraction, digestion, etc.), measurement, and method response under the conditions of testing (specific instrumentation, calibration, and quality control acceptance criteria). Each analytical method description must address precision, bias or accuracy (usually in percent recovery of spiked samples), detection limits for each parameter reported, and quality control evaluations applicable to the specific sample matrix.

Due to the volume of information, the QA manual and the multitude of individual SOPs are kept electronically on the "I" drive I: Lab: Lab Procedures: SOPs." This directory is available to all lab personnel as "read only" with the exception of those senior staff authorized to make revisions. Each revision is identified with a sequential numbers and paper and electronic copies are retained.

For NPDES compliance monitoring, only methods approved by 40 CFR Part 136.3, or the USEPA associated program will be used, or unless an alternative testing procedure has been approved by EPA Region X.

B5. Quality Control Requirements

This section describes control measures necessary to identify sources of measurement error within the laboratory, and to estimate their bias and variability (repeatability and frequency).

Function checks are performed to verify the stability and validity of the sample and the performance of testing and analytical equipment. The technician performing the test will be provided with control charts or ranges for each function check. Function checks are measurement/method or vendor-specific.

Control checks will be performed during the analytical or testing process. These checks are made on all analyses or tests, and intermittently after a specified number of procedures have been completed. Some control checks may be required as part of the routine analysis or test, and are performed by the analyst to determine the performance of the system. These control checks include: the use of sample blanks which must show a result below MDL if applicable or have a result that falls in a specified range; introduction of spiked samples to determine percentage of analyte recovery; second-source, certified laboratory control standards; and sample replicates to observe within- and between-run variability for the entire analysis. Other control checks are performed by the analyst or test technician intermittently to quantify analysis variability in terms of precision and accuracy. Control samples normally used for this purpose are sample aliquots to determine precision and standard reference materials or standard reference samples to determine accuracy in addition to precision. Results from selected function checks and control samples will be recorded on control charts or in LIMS: to track events showing that the system is in control; or to indicate what part of the system is the source of the error; and to provide an indication of the results of any corrective action. The QA/QC Coordinator is responsible for the establishment and monitoring of any control charts needed for laboratory performance control.

In addition to control charts, documentation (run log) may be kept of test parameters, instrument settings, and other test conditions depending on the instrument and the analyte. These run logs are available to analysts running the instrument and are reprinted whenever changes are made to instrument settings; after maintenance by a service engineer; or following a method modification.

B6. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The instrumentation requirements specified in referenced analytical methods, or as contained in the SOPs, are the guidelines for maintenance. Instrumentation installation date and subsequent modifications, updates and maintenance activities must be documented in each instrument's log book, supported by the manufacturer's instructions as appropriate. Instrument manufacturer's recommended maintenance schedules and spare parts inventory should be adhered to and documented. Additional maintenance may be performed at the discretion of the QA/QC Coordinator or an analyst running or preparing to run the test. These actions are logged in the instrument log book or denoted on maintenance sheets.

B7. Instrument Calibration and Frequency

Each instrument is calibrated according to the SOP for the test. Documentation that instrumentation is functioning properly to allow generation of the highest data quality is

demonstrated by the reading of an initial calibration verification standard, ICV, standard which is a same source standard as the calibration standards, and LCS, which is made from a NIST certified, second source (IE. manufacturer) than the calibration standards. Continued set or batch analyses calibration is verified with continuing calibration verification, CCV, checks. All calibrations are documented in the instrument logbook, on bench sheets or on the paperwork for the test. At a minimum, the calibration procedure and frequency recommended by the manufacturer or as specified by a method will be used and is documented in the SOP. Additionally, a preventative maintenance notification system using Outlook software is being developed. Formerly the Lab used a system in Groupwise, which the City recently replaced with Outlook that sent individual E-mail messages automatically to the Lab Manager's designee once per month, per quarter, semi-annually, or annually depending on the requirement. The designee then assigns and forwards the message to the appropriate person. The E-mail only disappears from the person's mailbox when the task is checked as "complete." This system is a reminder only; maintenance actions are logged as described in Section B6.

B8. Inspection/Acceptance Requirements for Supplies

All supplies, reagents, and analytical standards used during sampling and analysis meet strict acceptance criteria. Most supplies are purchased through a major national scientific warehouse and are marketed for the applied use. Chemicals which show evidence of leaks, freezing or other damage during shipping are rejected. Any time a significant change is made in the type of equipment, testing will be conducted to determine suitability for the contemplated use.

Additionally, the use of method blanks, field blanks, analytical blanks and laboratory control standards (LCS) provides continual validation that supplies and reagents are suitable.

Except for specific applications such as waste neutralization or cleaning, American Chemical Society (ACS) reagent or higher grade compounds are used. Many specialized applications require a higher or certified grade of chemical, and these are specified in each test's SOP. Laboratory control and calibration standards are from independent sources traceable to National Institute for Standards and Technology (NIST.) The lot numbers of the certified reference materials are recorded in a log book and the certificate of certification is filed.

B9. Data Acquisition Requirements

The sample information needed prior to analyzing the samples will be denoted on the chain-of-custody. Any problem seen with this form will be flagged by the sample maitre'd. As soon as possible, ACHD staff will be notified of the problem.

B10. Data Management

Data entry, validation, and verification functions are all integrated in the LIMS. In all cases bench sheets are completed by the laboratory technician who performed the test. Procedures for

filling out the bench and calculation sheets and subsequent data entry are provided in the QA Manual, reference sheets and SOPs for the individual tests.

To ensure uniform data are reported, the following rules are adopted:

1. Results are to be expressed in the appropriate number of significant figures.

2. As of January 2014, the Lab has simplified the rounding rules to accommodate and be consistent with instrument generated and Excel calculated data where results are rounded as follows: if the first digit to the right of the place the result is to be rounded is greater than or equal to 5, the previous digit is increased. Prior to this the Lab rounded data as above with the exception that if the digit was equal to 5 then rounding depended on the previous digit whether the result was rounded up or stayed the same. Even numbers stayed the same and odd numbers rounded up. This method of rounding is recommended in Section 1050 "Expression of Results" in *Standard Methods for the Examination of Water and Wastewater*. The Water Quality Lab staff researched various references on how to reference or integrate the 2 systems of rounding to no avail. Due to the increasing use of instrumentation and Excel calculation workbooks , the decision was made to simply the rounding and be consistent throughout result generation and calculation.

3. Results less than the MDL value are to be expressed <MDL (numeric value). All result recorded in LIMS are relevant to the method specific MDL.

4. For methods which the "minimum level" (CRQL or ML) is defined, this value is used when reporting undetected values. Examples are oil and grease, cyanide, low level mercury and priority pollutants.

Section 1050 "Expression of Results" in *Standard Methods for the Examination of Water and Wastewater* is used as the reference for determination of significant figures, rounding rules, etc.

Once the data is entered into the LIMS, the paperwork is reviewed by the QA/QC Coordinator to ensure that it is complete and the calculations are correct. The QA/QC Coordinator signs the bench sheet and returns the paperwork to the laboratory technicians/analysts for data entry review and validation. After all of the data on the bench sheet is validated, it is placed into the laboratory files.

After all tests are completed on a sample, the QA/QC Coordinator validates the sample and generates a report for the customer. This report is reviewed by the QA/QC Coordinator and then given to the Water Quality Lab Manager for review, signature, and distribution. A copy of all analysis reports are kept in the lab files. Electronic data and files are backed up as well.

At a minimum, two years of bench sheets, calculation sheets, log books, raw data print outs, and analysis reports are kept on-site. Files are organized by test, by calendar year, and often by month or quarter. These files are in a secured area with access limited to designated staff.

Prior to 2006: after three years, the above documents were inventoried and archived according to procedures set forth in Boise City Public Works Department "Records Management Program", rev. 2/00 *et seq.* These documents are retained in the City archives for a minimum of 10 more years.

In 2006, archiving of new hard copy documents had been discontinued by City policy. Lab documents archived in 2006 will be kept in a secure location in the West Boise "old pretreatment" building for a minimum or 10 years. This archiving will be the responsibility of the Water Quality Laboratory Manager.

C1. Assessments and Response Actions

Program assessment is continual and multi-faceted. Where possible, analytical results are compared to historical values with automatic warning generated at data entry by using limits set by the QA/QC Coordinator within the LIMS software. If a value greatly exceeds site history or is uncharacteristic, the sample is immediately re-run, when possible, to validate the anomalous result. If an excursion or atypically high value is verified, the Lab Manager will immediately alert ACHD storm water staff. Notification, remediation, and follow-up reporting as required by the NPDES permits would be administered by ACHD.

Blind performance samples are used within the lab to assess lab performance. The laboratory participates in annual EPA DMR-QA studies plus USGS studies. Individual lab analysts receive blind samples and a method review each year (see Section A8.)

C2. Reports

As soon as the analytical work, data entry, data review, and sample validation are completed for a storm water sample, the QA/QC Coordinator will print an analysis report and sample QC summary report. The standard report to be provided to ACHD will include all Tier I and II parameters listed below. Tier III reports are available upon request.

Tier I reporting: Lab identification number, analytical results, units, sample name, sample date, date of analysis, detection level (MDL x dilution factor), analyst, method reference, prep/digestion date, prep/digestion method reference, sample comments, data qualifiers and a copy of the chain-of-custody.

Tier II reporting: Tier I plus method blank, replicate relative percent difference, spike recoveries,

control standards, QC batch sample Lab identification number.

Tier III reporting: Tier I and II plus copies of raw data and bench sheets, instrumentation readouts, laboratory accepted QC ranges, time of analysis, instrument tunes, and digestion records.

Upon request, ACHD will be provided with updated copies of MDL lists and Control Chart Warning/Control limit summaries as they are revised over the year. Thus ACHD will have the accepted QC ranges for the tests as with a Tier III report; however this will not be redundantly attached to each analysis report. The contact for the latest version of these documents is the QA/QC Coordinator.

In addition to the providing hard copy reports as described above, electronic data may be exported to ACHD in various formats (ASCII, Excel, Access) The QA/QC Coordinator may be contacted for details.

D1. Data Review, Validation, and Verification Requirements

Data validation is the process in which data are checked and accepted or rejected based on a set of established criteria. This involves a critical review of a body of data in order to identify atypical values or outlying observations. The review may be only a quick scan to detect extreme values or a detailed evaluation requiring the use of a computer. In either situation, when an atypical value is identified, it is checked for validity. Records of values that are judged to be invalid or are otherwise doubtful will be retained. In some cases, an investigation report is generated by the QA/QC Coordinator and kept in files for 3 years on-site. In other cases, a note is made on the bench sheet and an explanation placed under "sample comments" in the LIMS data system. In all cases, an explanation and justification is provided

D2. Validation and Verification Methods

During method development, a method is set up using NPDES or program specific methods. The calibration curves, linear dynamic range, MDLs, precision and accuracy, are all established. Known interferences and method bias are investigated. Side by side analyses if possible are also done to validate a method. SOP are written to establish a standardized protocol and uniformity in technique amongst technicians. Some performance based methods require an initial precision and recovery (IPR) be performed by all technicians before they are approved to run a test and an ongoing precision and recovery (OPR) every analytical run. An IPR is when 4 standards specified by a method are analyzed which must meet the method specified precision and recovery stated in the method. An OPR is a standard specified in the method that meets the acceptable recovery standard and precision established within the method. Increasingly the use of IPR s for all methods is being implemented in place of or to supplement blind proficiencies.

The laboratory technicians do initial data validation at the time of testing. The analyst consults QC acceptance criteria or LIMS history and takes actions as needed to correct any unacceptable results. A second validation step occurs at data entry. Values may be compared to historical results by selecting the "history" button in LIMS. Additionally acceptance criteria have been pre-set by the QA/QC Coordinator. The data entry cell will turn a bright color if it is outside the acceptable range. The criteria for determining extreme values are based on a statistical analysis of each specific sample's results. Confirmation of data is required when a datum exceeds the acceptable range and actions are denoted in "sample comments."

After the QA/QC Coordinator reviews each bench sheet, a second lab staff member verifies all data entry. The software system (LIMS) holds data until this validation occurs. Data pending validation can be queried easily. The goal of the validation procedure is to confirm that the data on the bench sheet matches the data recorded in the LIMS, that the data recorded contains the correct number of significant figures, and that the result is expressed in the proper form.

After this data entry validation but before the results are available for reporting, the QA/QC Coordinator must validate the sample in LIMS. The data are reviewed for completeness, and agreement with historical values. After this validation, the sample results are able to be reported.

D3. Reconciliation with Data Quality Objectives

As soon as possible after data are generated, the QA/QC Coordinator compiles the event or sample report(s). In addition to the analytical results, these reports include all QC data from individual runs (method blanks, relative percent difference of replicate samples, spike recoveries, and laboratory control standard (LCS) recoveries) and any comments concerning the sample or a specific test. Anomalous results are confirmed with a re-run whenever possible and the results noted in "sample comments." In many cases, additional samples are collected and long-term sampling frequencies are increased to provide a better assessment of the situation.

If a concern exists with the quality of the analytical result in terms of equipment failure, calibration or maintenance failure, the unit will be repaired or techniques reassessed and improved. If the problem is lab error or poor technique, the lab analysts will be re-trained and tested.

If analytical run QC results are acceptable, the anomalous data are compared to historical values and any notable changes are investigated. If the event trip and/or equipment blanks show results above the method detection limit (MDL), an investigation and follow-up actions ensue.

Appendix A: Boise City Water Quality Lab Organization

Operations Manager -Marcia Schmelzer
Water Quality Lab(WQL) Manager- Janet Finegan-Kelly
QA/QC Coordinators

Leslea Basterrechea	Karen Griffin

Brady Callahan WQL LIMS/ Analyst

Barbra Bongiovi WQL Assistant

Metals Labs
Denise Twohig WQL Technician
Eric Milliron WQL Analyst
Anna Orrison WQL Analyst
Heather Rankin WQL Analyst
David Wiley WQL Analyst

Wet Chemistry Labs	
Kathy Riley WQL Analyst	Sandra Werner WQL Supervisor
April Griffith WQL Analyst	April Griffith WQL Technician
Stephen Quintero WQL Analyst	Leslie Ogden WQL Technician
	Denise Twohig WQL Technician
	Julie Robinson WQL Technician
	Chris Pajak WQL Technician
	Jami Lough (0.8) WQL Technician
Employees in grey report to Water Quality Lab (WQL)Supervisor	Shannon Reich WQL Technician
	Azubike Emanari WQL Technician
	Part time Temps
	Maxine Prior WQL Technician
	Ryan Omialowski WQL Technician
	Eric Tretter WQL Technician
	James Mitchell WQL Technician
	David Kummer (retired) WQL Technician

A. Water Quality Lab Manager: Janet Finegan-Kelly (reports to Marcia Schmelzer, Operations Manager)

B. QA/QC Coordinators: Karen Griffin and Leslea Basterrechea (report to Janet Finegan-Kelly, Water Quality Lab Manager)

C. Water Quality Lab Supervisor: Sandra Werner(reports to Janet Finegan-Kelly) supervises the following Water Quality Lab Analysts: Kathy Riley, Stephen Quintero, April Griffith, and Water Quality Lab Technicians: Jami Lough, Chris Pajak, Julie Robinson, Leslie Faulkner, Azubike Emanari, Maxine Prior, Ryan Osmialowski, Eric Tretter, James Mitchell, David Kummer

D. Water Quality Lab Analysts: David Wiley, Eric Milliron, Anna Orrison, Heather Rankin, Brady Callahan (report to Janet Finegan-Kelly, Water Quality Lab Manager)

E. Water Quality Lab Technician (Metals lab): Denise Twohig (reports to Janet Finegan-Kelly, Water Quality Lab Manager)

F. Water Quality Assistant: Barbra Bongiovi (reports to Janet Finegan-Kelly, Water Quality Lab Manager)

Appendix B: Contact List for Senior Boise City and ACHD Staff Involved with NPDES Compliance

Boise City

1. Water Quality Lab Manager
   Janet Finegan-Kelly, tel: 208/608-7263, fax 208-608-7319,
   jkelly@cityofboise.org

2. QA/QC Coordinator
   Leslea Basterrechea, tel: 208/608-7264, fax 208-608-7319,
   lbasterrechea@cityofboise.org

3. QA/QC Coordinator
   Karen Griffin, tel: 208/608-7262, fax 208-608-7319,
   kgriffin@cityofboise.org

4. Wet Chemistry Lab Supervisor
   Sandra Werner tel: 208/608-7299 fax 208/608-7319
   swerner@cityofboise.org

ACHD

1. ACHD Storm Water Quality Coordinator
   Monica Lowe, tel: 208/387-6255 cell 208/861-1864
   mlowe@achdidaho.org

2. ACHD Storm Water Quality Specialist
   Adam Van Patten tel: 208/387-6268 cell 208/484-0031
   avanpatten@achdidaho.org

3. ACHD Storm Water Quality Specialist
   Ann Lefler tel: 208/387-6383 cell 208/861-6234
   alefler@achdidaho.org

Appendix C: Job Descriptions of Laboratory Staff Involved with NPDES Compliance http://agency.governmentjobs.com/boiseid/default.cfm?action=agencyspecs

1. Water Quality Lab Manager
2. Wet Chemistry Laboratory Supervisor
3. QA/QC Coordinator
4. Water Quality Lab Analyst
5. Water Quality Lab Technician
6. Water Quality Assistant

Appendix 19
Resolution 2152 and *ACHD Spill Response Plan*

RESOLUTION NO. 2152

BY THE ADA COUNTY HIGHWAY DISTRICT BOARD OF COMMISSIONERS: KENT GOLDTHORPE, PAUL WOODS, REBECCA W. ARNOLD, SARA M. BAKER AND JIM D. HANSEN

A RESOLUTION PROVIDING FOR THE REPEAL OF RESOLUTION 812 AND ADOPTION OF A NEW INTERNAL POLICY FOR RIGHT-OF-WAY SPILL, CONTAINER AND DEBRIS RESPONSE AND A NEW SPILL RESPONSE PLAN AS INTERNAL GUIDANCE DOCUMENTS OF THE ADA COUNTY HIGHWAY DISTRICT.

WHEREAS, Ada County Highway District has jurisdiction and responsibility for all public highways and public rights-of-way within Ada County, Idaho, except state highways and interstate freeways; and

WHEREAS, the health and safety of Ada County Highway District employees is of the utmost concern to the Ada County Highway District Commissioners and Director; and

WHEREAS, on occasion, ACHD personnel may witness or discover in the right-of-way, spills of hazardous and/or unknown substances and various pollutants and common waste, as well as containers which may contain hazardous and/or unknown substances; and

WHEREAS, pursuant to Occupational Safety and Health Administration (OSHA) Regulation 29 CFR § 1910.120(q), ACHD personnel who may witness or discover in the right-of-way, spills of hazardous substances and containers which may contain hazardous substances are considered “emergency response” personnel. OSHA Regulation 29 CFR § 1910.120(q)(6) “emergency response” personnel must be appropriately trained depending upon their duties and functions relating to an emergency; and

WHEREAS, the ACHD Board of Commissioners and Director are committed to appropriate training of ACHD Construction Inspectors and Maintenance field personnel and in accordance with OSHA Regulation 29 CFR § 1910.120 and to ensure that such ACHD personnel have first responder awareness level training and the knowledge to initiate an emergency response sequence by notifying the property authorities of the release and to stay out of harm’s way in a spill response situation; and

WHEREAS, the ACHD Board of Commissioners and Director are committed to appropriate training of ACHD Maintenance on-call personnel and supervisors in accordance with OSHA Regulation 29 CFR § 1910.120, to ensure that such ACHD personnel have first responder operator level training and the knowledge to initiate an emergency response sequence by notifying the proper

authorities of a release and are able to direct and/or participate in defensive measures in the "safe zone" as determined by the on scene incident commander, to prevent hazardous substances and pollutant wastes from entering into the storm water drainage system only if such measures are deemed by such Maintenance on-call personnel and supervisors to be necessary and essential to prevent contamination of the storm water drainage system and no other public or private resources are immediately available; and

WHEREAS, in the interest of ACHD employee health and safety, the ACHD Commissioners and Director have determined that ACHD staff will not directly participate in hazardous substance clean up and that only properly trained and/or directed ACHD personnel may participate in limited containment of hazardous substances and pollutant wastes; and

WHEREAS, Environmental Protection Agency (EPA) Regulation 40 CFR § 122.26(d)(2)(iv)(B)(*4*), requires that applications for NPDES permits for large and medium municipal separate storm sewer systems include, "[a] description of procedures to prevent, contain, and respond to spills that may discharge into the municipal separate storm sewer."; and

WHEREAS, in addressing EPA Regulation 40 CFR § 122.26(d)(2)(iv)(B)(*4*), ACHD's NPDES permit provides in pertinent part: "f) Prevent and Respond to Spills to the MS4. Throughout the Permit term, the Permittees must coordinate appropriate spill prevention, containment and response activities throughout all appropriate departments, programs and agencies to ensure maximum water quality protection at all times."; and

WHEREAS, adoption and implementation of an internal policy for right-of-way spill, container and debris response and a plan for right-of-way spill response which establish requirements for employee training and which clearly sets forth roles and responsibilities for ACHD personnel who may be engaged in such response will enhance ACHD's risk management efforts in the areas of employee health and safety and incident management and response and will also assist ACHD's efforts to comply with applicable regulations of the OSHA and EPA; and

WHEREAS, on June 13, 2007 the Ada County Highway District Board of Commissioners adopted Resolution 812 adopting and implementing the ACHD Standard Operating Plan for Right-of-Way Spill, Container and Debris Response, as an internal policy and guidance document of the Ada County Highway District and ACHD staff has reviewed the aforementioned Standard Operating Plan for Right-of-Way Spill, Container and Debris Response and prepared various revisions to it in the form of a proposed replacement Policy for Right-of-Way Spill, Container and Debris Response as an internal policy and a separate Spill Response Plan and it is in the interest of ACHD employee health and safety to repeal Resolution Number 812 and adopt a new and replacement Policy for

Right-of-Way Spill, Container and Debris Response as an internal policy and a separate Spill Response Plan; and

WHEREAS, it is the interest of ACHD employee health and safety to authorize ACHD staff to revise and modify the Spill Response Plan that is adopted by this Resolution as such revisions and modifications may be deemed necessary from time to time by the ACHD Director to ensure the information is current, relevant and applicable to ACHD spill response activities and consistent with the Policy for Right-of-Way Spill, Container and Debris Response.

NOW, THEREFORE, BE IT RESOLVED, that the Ada County Highway District Board of Commissioners does hereby repeal Resolution Number 812 and adopts and implements the attached Policy for Right-of-Way Spill, Container and Debris Response (Attachment "1") and a separate Spill Response Plan (Attachment "2") and the Commissioners do hereby authorize ACHD staff to revise and modify the Spill Response Plan that is adopted by this Resolution as such revisions and modifications may be deemed necessary from time to time by the ACHD Director to ensure the information is current, relevant and applicable to ACHD spill response activities and consistent with the Policy for Right-of-Way Spill, Container and Debris Response.

BE IT FURTHER RESOLVED, that this Resolution shall be in full force and effect immediately upon its adoption and approval.

Adopted and approved by the Board of Commissioners of the Ada County Highway District on the 20th day of July, 2016.

BOARD OF HIGHWAY DISTRICT COMMISSIONERS OF
ADA COUNTY, IDAHO:

Kent Goldthorpe, President

Paul Woods, Vice President

Rebecca W. Arnold, Commissioner

absent
Sara M. Baker, Commissioner

Jim D. Hansen, Commissioner



ACHD SPILL RESPONSE PLAN

July 2016

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1.0 Purpose

The purpose of this document is to provide Ada County Highway District (ACHD) staff guidance on responsibilities, operating procedures, implementation, and training, associated with spill response in the ACHD right-of-way (ROW) by ACHD staff or ACHD contractor. The ACHD Spill Response Plan (Plan) outlines how ACHD will implement the *ACHD Policy for Right-of-Way Spill, Container, and Debris Response, Resolution #XXXX* (Spill Policy), located in Appendix A. The Plan will be amended as needed to ensure the information is current, relevant and applicable to ACHD spill response activities and consistent with the Spill Policy. Any changes to the Spill Policy must be approved by the ACHD Commission.

2.0 Definitions

For the purpose of this Plan and the Spill Policy the following definitions apply.

Hazardous Substance – Liquid or solid material or waste that poses an immediate health or safety risk to people, i.e. strong corrosives, strong oxidizers, radioactive material, flammable, explosive, etc. ***An unknown substance is presumed to be hazardous.***

Pollutant Waste – Liquid or solid waste that is not health or life threatening but poses an unreasonable risk to the environment, i.e. oil, gas, antifreeze, paint, etc.

Common Waste – Liquid or solid waste that can be disposed of at the local landfill without any special considerations, i.e. household waste, construction waste, debris, etc.

Household Hazardous Waste – Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients.

Critical Spill – Any spill where vapors, smoke, dead or injured animals or people at the site of the spill or have any reason to believe the material is a hazardous substance.

Moderate Spill – Any spilled material of known pollutant waste over 25 gallons. Any petroleum spills of any amount which causes a sheen on navigable waters, or is flowing into the storm water drainage system. Quantity is characterized as large.

Incidental Spill – Any known common waste, pollutant waste, or debris that is less than 25 gallons total. Quantity is characterized as small.

Spiller – The person responsible for causing the spill to occur.

Safe Zone – Contamination-free zone established away from the spill where emergency operations can be directed and supported.

3.0 Key Spill Response Principles

Every spill response incident will vary. ACHD staff response is directly related to the nature of the spill or container, the quantity of the spilled material. The purpose of this section is to

provide ACHD staff general guidance that applies to most spills and containers in the ACHD ROW and direction based on ACHD's Spill Policy. A laminated flow chart is provided in all vehicles as a quick reference (also located in Appendix B).

ACHD's **Key Response Principles** are:

- **Level of response is based on type and amount of waste and personnel level of training**

- Identify Spill Classification:
  - **Incidental Spill** (common waste or small quantities of pollutant waste)
  - **Moderate Spill** (known pollutant waste in quantities over 25 gallons that may be a threat to the environment)
  - **Critical Spill** (hazardous substances that may be an immediate threat to public health - ***an unknown substance is presumed to be hazardous*****)**

- **Containers are presumed to contain hazardous materials. DO NOT REMOVE** any container unless you are able to visually determine from a safe distance, with complete and absolute certainty, that the container contains a small quantity of known pollutant waste or common waste.

- **Stay in the "safe zone" and do not get directly involved in hazardous spill cleanup.**

- **Maintenance on-call supervisors may direct or participate in defensive measures in the "safe zone"** to prevent hazardous substances from entering into the stormwater drainage system only if such measures are essential to prevent contamination of the stormwater drainage system and no other public or private resources are immediately available.

- **Always** attempt to identify the spiller or owner of the container and advise on proper disposal.

- **Intact containers of pollutant waste should be recycled using our current onsite disposal methods (i.e. gasoline, oil, antifreeze).** Anything not recycled or correctly disposed of at our yards should be taken to the Ada County Landfill Household Hazardous Waste Facility, open Friday and Saturdays 8am to 6pm, as soon as possible. Intact containers can be temporarily stored on a pallet in isolation, designated by the Maintenance Superintendent or Safety Coordinator.

- General precautions and actions include:
  - **Stay uphill and upwind**
  - **Advise those at the scene to stay back, at a safe distance from spill**
  - **Follow notification procedures (Section 6.2)**
  - **Assist in traffic control as necessary**

4.0 ACHD Staff Spill Response Roles and Responsibilities

Spill response is an activity that may involve numerous ACHD staff, primarily from the Maintenance and Engineering Divisions. This Plan applies to spills in the ACHD ROW. If a spill occurs outside of the ROW, contact the proper authority based on jurisdiction (i.e. City of Boise, Ada County etc.). Refer to Appendix C for contacts. Contact the Stormwater Quality Specialist if you need help determining the proper authority.

4.1 Overview

Roles and responsibilities for spill response vary based on staff expertise, position duties within the ACHD organization, level of training, and the time and day of the spill response. Following are the roles and responsibilities of the ACHD staff involved with ACHD spill response.

4.2 On-Call Supervisor

The On-Call Supervisor is the first point of contact for critical and moderate spills within ACHD ROW. These spills, defined in section 2.0, Definitions, are suspected to be hazardous substances or large quantity spills (>25 gallons of nonhazardous waste e.g. gasoline, paint, oil, etc.). ACHD Lead Workers and Crew Chiefs serve in the On-Call Supervisor role on a scheduled rotating basis. The On-Call Supervisor's responsibilities are divided according to location into east Ada County (Adams On-Call Supervisor) and west Ada County (Cloverdale On-Call Supervisor). An On-Call Supervisor is designated each week for Cloverdale and Adams and is available 24 hours a day. Each Tuesday at 8:00AM a new Lead Worker or Crew Chief is assigned the On-Call Supervisor responsibility for the week. The contact numbers for the On-Call Supervisor at Cloverdale and Adams are the two same numbers regardless of the person on duty. These numbers are listed on the Spill Response Flow Chart, Appendix B as well as Contacts, Appendix C.

In addition to a designated cell phone, an on call bag with this Plan is transferred each week to the On-Call Supervisor. During regular office hours (8:00 AM – 4:30 PM), the Administrative Specialists at Cloverdale and Adams are often the first to become notified of a spill from the public or field personnel requesting assistance. The Administrative Specialists first call will be to notify the On-Call Supervisor.

After business hours the On-Call Supervisor has all the responsibilities of the Maintenance Superintendent. The On-Call Supervisor also has the following responsibilities:

- Serves as initial point of contact for Critical Spills and Moderate Spills;
- Initiates call to 911 and coordinates with the Maintenance Superintendent and Stormwater Quality Specialist during office hours;
- Requests additional reinforcements as needed (i.e. additional Maintenance Superintendent, Crew Chiefs, Lead Workers, etc.);
- Contacts environmental contractor if needed; works with responsible party to ensure proper cleanup;

- Ensures all documentation is complete and forwarded to appropriate parties; and
- Briefs Maintenance Superintendent, as needed.

4.3 Maintenance Superintendent

The Maintenance Superintendent is responsible for the operation of ACHD's respective Maintenance Section. Maintenance Superintendent responsibilities are divided between Cloverdale and Adams. In addition, the Maintenance Superintendent has the following responsibilities:

- Provides assistance and guidance to On-Call Supervisor during Critical Spills and Moderate Spills;
- Authorizes contracting of environmental cleanup services;
- Requests additional reinforcements and expertise as needed i.e. additional Maintenance Superintendent, Crew Chiefs, Lead Workers;
- Oversees complete cleanup of critical spills from start to finish; and
- Ensures all documentation is complete and forwarded to appropriate parties.

4.4 Stormwater Quality Specialist

The Stormwater Quality Specialist is responsible for working with Maintenance Superintendent, Safety Coordinator, and Training Specialist to update the Spill Response Plan as needed. In addition, the Stormwater Quality Specialist has the following responsibilities:

- Provides guidance on proper spill cleanup procedures;
- Provides training on the Plan annually;
- Coordinates with the Training Specialist to ensure NPDES required training elements on spill response and illicit discharge are met; and
- Tracks and compiles all spill response actions that originate from the public and require use of ACHD or contractor equipment for NPDES annual report documentation.

4.5 Safety Coordinator

The Safety Coordinator is responsible for review of the Plan with regards to ACHD personnel and public safety concerns. Modifications to this Plan that result in less protective measures than those specified may not be employed without approval by the Safety Coordinator. In addition, the Safety Coordinator has the following responsibilities:

- Develops and coordinates the overall ACHD health and safety program;
- Recommends appropriate safeguards and procedures with regards to Personnel Protective Equipment (PPE) and ACHD personnel safety;

- Conducts accident/injury investigations and recommends corrective measures to prevent reoccurrence of an injury or accident;
- Follows up on large or dangerous spill activities to make sure maintenance crews responded in a safe manner; and
- Coordinates with the Training Specialist as needed, to ensure safe procedures are taught to both the First Responder Awareness (Section 8.1) and Operator Training levels (Section 8.2).

4.6 Training Specialist

The Training Specialist develops and provides training resources to ACHD personnel. The Training Specialist assures training requirements for spill response training meet OSHA Regulations 29 CRF 1910.120 (q)(6)(i) and (ii) as stated in the ACHD Policy for *Right-of-Way Spill, Container, and Debris Response* (Appendix A). In addition, the TS have the following responsibilities:

- Ensures appropriate level of training depending on ACHD personnel's role in spill response;
- Evaluates competency in various training areas as required;
- Schedules, documents, and ensures training meets all required elements; and
- Coordinates with the Stormwater Quality Specialist on NPDES required training on spill response and pollution prevention.

4.7 Field Staff

Field Staff are often first to observe a spill within ACHD's ROW. Field Staff's primary responsibility with regard to spill response is to contact the On-Call Supervisor and the Stormwater Quality Specialist in case of a moderate or critical spill. In addition, Field Staff has the following responsibilities:

- Directs and assists in cleanup of incidental spills, including applying absorbent and asking for assistance from sweepers if needed;
- Documents spill on Illicit Discharge Report Form (Form ID1a), available on ACHD's intranet, or providing information to Administrative Assistant to complete form. Form ID1a is also in Appendix D of this document;
- Ensures documentation has been provided to the Stormwater Quality Specialist; and
- Disposes of common waste at Hidden Hollow Landfill, as applicable.

5.0 Waste Disposal

Disposal of waste from the ACHD ROW is dependent on type, quantity, and state of matter, i.e. solid or liquid material you are disposing. Qualified contractors will be hired for cleanup and disposal of pollutant spills over 25 gallons and hazardous materials spills.

The wastes that ACHD crews may encounter and be responsible for disposing of are:

- Trash, debris, and small amounts of contaminated soil (1 cubic foot or less);
- Containers of pollutant waste and intact containers of household hazardous waste; and
- Less than 25 gallons of pollutant waste that has been bound to absorbent.

Descriptions for these waste types and proper disposal methods are:

- Common Waste
  - Consists of trash, debris, or any product that does not have special disposal instruction on its label
  - Can be disposed of in an appropriate waste receptacle

- Pollutant Waste
  - Consists of substances such as gasoline, antifreeze, grease/oil, paint
  - Intact labeled containers of pollutant waste should be recycled using our current onsite disposal methods (i.e. gasoline, oil. antifreeze). Anything not recycled or correctly disposed of at our yards should be taken to the Ada County Landfill Household Hazardous Waste Facility, open Friday and Saturdays 8am to 6pm, as soon as possible. Intact containers of can be temporarily stored on a pallet in isolation, designated by the Maintenance Superintendent or Safety Coordinator.
  - Pollutant waste that has been spilled and subsequently cleaned up with granular absorbent should be disposed of as the regular street sweepings.

- Household Hazardous Waste/ Hazardous Waste
  - Consists of substances such as pesticides; bleach, solvents, and chlorine.
  - Intact containers should be taken the Ada County Landfill Household Hazardous Waste Facility, open Friday and Saturdays 8am to 6pm, as soon as possible. Intact containers can be temporarily stored on a pallet in isolation.
  - Anything not in an intact, labeled container should be disposed of by our environmental contractor.

- Contaminated Soil
  - Take to L & R Environmental Land Farm. See Appendix C, Contacts, for location and phone number.

ACHD has a fee waiver agreement with Ada County which includes the Ada County Landfill. Disposal of common and pollutant waste at the Ada County Landfill is the preferred method of disposal. The household hazardous waste facility allows a maximum of 220 pounds per month. If this limit is exceeded a contractor will be called to dispose of the waste.

6.0 Documentation

Documentation and reporting are an essential component of ACHD's spill response activities. Documentation entails completing the Illicit Discharge Report Form ID1a (Appendix D). This form is also available electronically on ACHD's intranet under Forms – Maintenance.

Maintenance Administrative Specialists and the Stormwater Quality Specialist can assist with completing the form as needed.

6.1 What Spills are Documented?

All complaints, inquiries, and investigations regarding spills or containers ACHD receives from the public (including those from Tellus) will be documented. Additionally, all spill response initiated by ACHD staff will be documented including:

- Response during the course of normal work activities;
- Response due to referral or request from another agency that requires ACHD equipment or a contractor to be used for cleanup.

If the spill response was initiated by ACHD staff, but does not involve ACHD equipment or a contractor for cleanup, it will not be documented. For example, a spill that can be cleaned using absorbent and a push broom, or a known substance that can be disposed of at the landfill or in the garbage.

As a general rule, if the spill is large enough that a sweeper or vac truck is needed or cannot simply be thrown away; it should be documented and submitted to the Stormwater Quality Specialist.

6.2 Documentation Process

The following actions should be taken for documenting spills in the ACHD ROW. Field Staff, Maintenance Superintendent, and Stormwater Quality staffs are involved in the documentation process.

- Field Staff will complete Form ID1a and submit it to the Stormwater Quality Specialist.
- Hazardous waste response should also be documented on Form ID1a and additional actions, as listed in Section 6.3, should be followed.
- The Stormwater Quality Specialist will take completed Form ID1a and upload it into TRAKit.
- The Stormwater Quality Specialist will report on annual spill response activities (Oct 1 – Sept 30) in ACHD's annual NPDES reports.

6.3 Hazardous Waste Records and Retention

A Uniform Hazardous Waste Manifest will be requested by the Maintenance Superintendent and a copy retained by the Stormwater Quality Specialist in all cases that an environmental contractor is used for transport of a hazardous waste for off-site treatment, recycling, storage, or disposal.

7.0 Cost Recovery

By law the spiller or container owner is responsible for all cleanup costs; consequently, ACHD can recover labor, equipment, and supply costs used in responding to a spill or container from the spiller or container owner. If the spill cleanup or container removal is coordinated by ACHD or an ACHD contractor, then ACHD will be responsible for initiating cost recovery. The Maintenance Superintendent will initiate cost recovery, if warranted, by submitting a Damage Claim Form (Appendix E) to ACHD's Administration Department, Accounting.

If the response is coordinated via StateComm, Idaho Department of Environmental Quality will manage field cleanup activities and the Idaho Bureau of Homeland Security will coordinate cost recovery. Appendix F includes the paper work required by the Bureau of Homeland Security for cost recovery.

8.0 Training

ACHD will implement training consistent with the training requirements set forth in OSHA Regulations 29 CFR 1910.120 (q)(6). This training is focused at two levels of training, the First Responder Awareness Level and the First Responder Operations Level. These levels of training and the personnel required to complete the training is described below.

8.1 First Responder Awareness Level

This training is required for all Field Staff at Supervisor's discretion, excluding Lead Workers and Crew Chiefs.

First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. First responders at the awareness level shall have annual First Responder Awareness training after which they can objectively demonstrate competency in the following areas:

1910.120(q)(6)(i)(A)
An understanding of what hazardous substances are, and the risks associated with them in an incident.

1910.120(q)(6)(i)(B)
An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.

1910.120(q)(6)(i)(C)
The ability to recognize the presence of hazardous substances in an emergency.

1910.120(q)(6)(i)(D)
The ability to identify the hazardous substances, if possible.

1910.120(q)(6)(i)(E)

An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.

1910.120(q)(6)(i)(F)
The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.

8.2 First Responder Operator Level

This training is required for all Crew Chiefs, Lead Workers, Maintenance Superintendents, and designated Stormwater Quality Specialists.

First responders at the operator level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operator level shall have annual ACHD Spill Response Plan training and at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

1910.120(q)(6)(ii)(A)
Knowledge of the basic hazard and risk assessment techniques.

1910.120(q)(6)(ii)(B)
Know how to select and use proper personal protective equipment provided to the first responder operational level.

1910.120(q)(6)(ii)(C)
An understanding of basic hazardous materials terms.

1910.120(q)(6)(ii)(D)
Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.

1910.120(q)(6)(ii)(E)
Know how to implement basic decontamination procedures.

1910.120(q)(6)(ii)(F)
An understanding of the relevant standard operating procedures and termination procedures.

8.3 Spill Response Plan Training

This training is required for all Field Staff, Crew Chiefs, Lead Workers, Maintenance Superintendents, and designated Stormwater Quality Specialists.

All Staff who receive the training outlined in Sections 8.1 and 8.2 will also be trained annually on this Spill Response Plan. The Spill Response Plan training will be conducted by the Stormwater Quality Specialist in coordination with the Training Specialist. The focus of this training will be on operating procedures, communication, coordination and documentation of the response.

The Spill Response Plan training, in addition to the training discussed in Sections 8.1 and 8.2, fulfills NPDES Phase I permit requirements that state all construction inspectors and maintenance field staff must be trained to identify and eliminate illicit discharges, spills, and illicit connections to the Municipal Separate Storm Sewer System.

APPENDIX A SPILL POLICY

ACHD POLICY FOR RIGHT-OF-WAY
SPILL, CONTAINER AND DEBRIS RESPONSE

1.0 Right-of Way Spill, Container and Debris Response Directive

The ACHD Commissioners and Director, in the interest of ACHD employee's safety and health, have determined that ACHD staff will not directly participate in hazardous substance clean up and that only properly trained and/or directed personnel may participate in limited containment of hazardous substances and pollutant wastes.

Containers are presumed to contain hazardous waste and are not to be removed by ACHD staff unless they can be visually determined from a safe distance, with complete and absolute certainty, to contain a small quantity of pollutant waste or common waste (see 2.0, Definitions) and the owner is unknown or unwilling to remove the container.

ACHD will implement training consistent with the training requirements set forth in OSHA Regulations 29 CFR 1910.120 (q)(6). This training is focused at two levels of training, the First Responder Awareness Level and the First Responder Operations Level. These levels of training and the personnel required to complete the training are described in Section 3.0. This training and associated implementation and documentation are also consistent with ACHD's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements.

The ACHD Plan for Right-of-Way Spill, Container, and Debris Response Plan (ACHD Spill Response Plan) will be updated as needed and will remain consistent with this resolution. The ACHD Spill Response Plan outlines procedures for addressing spills in the Right-of-Way, including notification procedures, roles, training, contact numbers, report forms, and disposal information.

2.0 Definitions

Hazardous Substance – Liquid or solid material or waste that poses an immediate health or safety risk to people, i.e. strong corrosives, strong oxidizers, radioactive material, flammable, explosive, etc. ***An unknown substance is presumed to be hazardous.***

Pollutant Waste – Liquid or solid waste that is not health or life threatening but that poses an unreasonable risk to the environment, i.e. oil, gas, antifreeze, paint, etc.

Common Waste – Liquid or solid waste that can be disposed of at the local landfill without any special considerations, i.e. household waste, construction waste, debris, etc.

Critical Spill – Any spill where vapors, smoke, dead or injured animals or people are observed at the site of the spill or there is reason to believe the material is a hazardous substance.

Moderate Spill – Any spilled material of known pollutant waste over 25 gallons. Petroleum products of any amount which cause a sheen on navigable waters, or are flowing into the stormwater drainage system. Quantity is characterized as large.

Incidental Spill – Any known common waste, pollutant waste, or debris that is less than 25 gallons, total. Quantity is characterized as small.

Safe Zone – Contamination-free zone established away from the spill where emergency operations can be directed and supported.

3.0 Training

ACHD will implement training consistent with the training requirements set forth in OSHA Regulations 29 CFR 1910.120 (q)(6). This training is focused at two levels of training, the First Responder Awareness Level and the First Responder Operations Level. These levels of training and the personnel required to complete the training are described below.

First Responder Awareness Level - Construction Inspectors and Maintenance Field Staff

First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. First responders at the awareness level shall have yearly ACHD Spill Response Plan training after which they can objectively demonstrate competency in the following areas:

1910.120(q)(6)(i)(A)
An understanding of what hazardous substances are, and the risks associated with them in an incident.
1910.120(q)(6)(i)(B)
An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
1910.120(q)(6)(i)(C)
The ability to recognize the presence of hazardous substances in an emergency.
1910.120(q)(6)(i)(D)
The ability to identify the hazardous substances, if possible.
1910.120(q)(6)(i)(E)
An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.
1910.120(q)(6)(i)(F)
The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.

First Responder Operator Level – Maintenance On-Call Supervisors

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have yearly ACHD Spill Response Plan training and at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

1910.120(q)(6)(ii)(A)
Knowledge of the basic hazard and risk assessment techniques.
1910.120(q)(6)(ii)(B)
Know how to select and use proper personal protective equipment provided to the first responder operational level.
1910.120(q)(6)(ii)(C)
An understanding of basic hazardous materials terms.
1910.120(q)(6)(ii)(D)
Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.
1910.120(q)(6)(ii)(E)
Know how to implement basic decontamination procedures.
1910.120(q)(6)(ii)(F)
An understanding of the relevant standard operating procedures and termination procedures.

The roles, responsibilities, and level of training required within ACHD's organization are defined in the ACHD Spill Response Plan.

4.0 **Procedures**

Specific procedures for response to a spill in the Right-of-Way by ACHD staff are directly related to the:

- nature of the spill or container
- quantity of the spilled material, and
- staff training

Classification of spills based on type, i.e. Common Waste, Pollutant Waste and Hazardous Substance, are defined in section 2.0, Definitions. Classification of spills based on quantity from Incidental Spills to Critical Spills is also defined in section 2.0, Definitions.

Roles and responsibilities for spill response vary based on staff expertise, duties within the ACHD organization, level of training, the time and day of the spill response. The procedures and coordination within ACHD's organization is detailed in the ACHD Spill Response Plan.

Containers are presumed to contain hazardous materials. **DO NOT REMOVE** any container unless you are able visually determine from a safe distance, with complete and absolute certainty, that the container contains a small quantity of known pollutant waste or common waste and you are unable to determine the identity of the person that left the container in the right-of-way or such person can be identified but is unwilling or unable to take custody over the container.

5.0 Documentation

Citizen complaints, inquiries, and investigations regarding spills or containers ACHD receives from the public will be documented. Additionally, spill response initiated by ACHD staff that uses ACHD equipment or contractor cleanup will be documented. The documentation process for spills in the ACHD ROW is detailed in the ACHD Spill Response Plan.

6.0 Cost Recovery

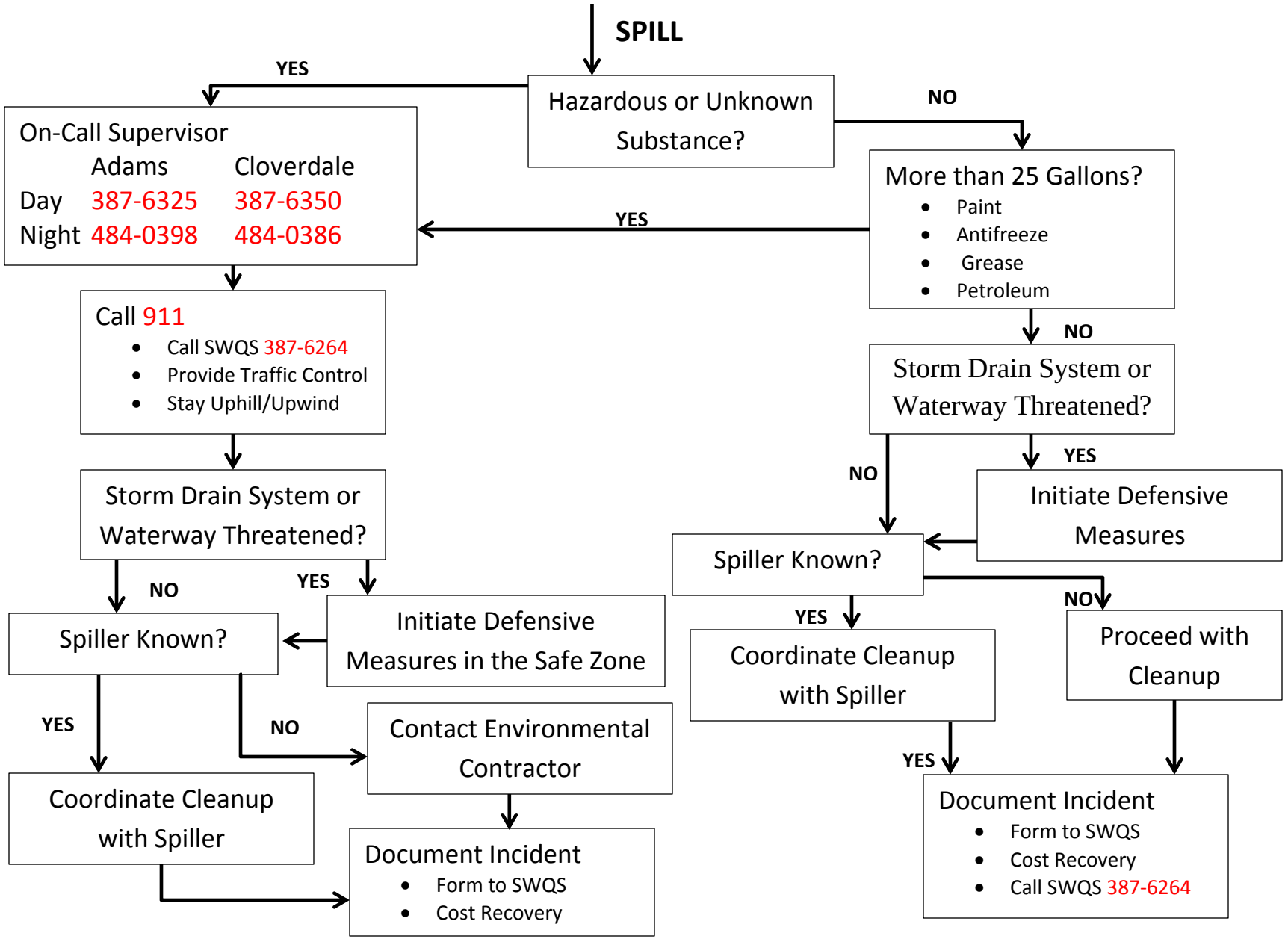
By law the spiller or container owner is responsible for all cleanup costs; consequently, ACHD can recover labor, equipment, and supply costs used in responding to a spill or container from the spiller or container owner. If the response is coordinated via StateComm, Idaho Department of Environmental Quality will manage field cleanup activities and The Bureau of Homeland Security will coordinate cost recovery. If the spill cleanup or container removal was coordinated by ACHD or an ACHD contractor, then ACHD will be responsible for cost recovery.

7.0 Pollutant Waste Disposal

Disposal of waste from the ACHD ROW is dependent on the type, quantity, and state of matter, i.e. solid, liquid, etc. Descriptions of waste types and appropriate disposal methods and contacts are available in the ACHD Spill Response Plan. Qualified contractors will be hired for disposal of hazardous substances and pollutant waste over 25 gallons.

APPENDIX B FLOW CHART

SPILL RESPONSE FLOW CHART



APPENDIX C CONTACTS

Spill Response Contractor

Master Rooter/Master Environmental	888-9191	Services: 24 hour service, hazardous material disposal, sewer disposal, vac truck, drain field cleaning, and video camera line inspection equipment. They will not dispose of mercury.
Mark Fisher - Rooter Account Manager	573-1700 (cell)	
Travis Bruegeman Environmental Account Manager	870-2423 (cell)	
H2O Environmental	343-7867	6679 S Supply Way
Joe Wickenden - Account Manager	602-8986 (cell)	Boise, ID 83716

Sewer Contractor Cleanup

Master Rooter/Master Environmental	888-9191	Services: sewer disposal 24 hour service hi velocity jetting machine, drain field cleaning, tv video camera line inspection equipment and septic tank installation and repair.
Mark Fisher - Rooter Account Manager	573-1700 (cell)	
Travis Bruegeman Environmental Account Manager	870-2423 (cell)	
Roto Rooter	562-8040	Services: 24 hour service hi velocity jetting machine, drain field cleaning, and video camera line inspection equipment.

Dead Animals in Right-of-Way

Idaho Humane Society	342-3508	Services: Dead animal pick up in Ada County.
Animal Control - Idaho Humane Society	343-3166	Services: Provide animal control for public nuisance, running loose, injured, or barking animals.
Fish & Game - Southwest Region	465-8465	Services: Dispose of large game animals.
Darling International	344-8318	Services: A for profit service to dispose of livestock.

Pollutant Waste Disposal Facilities

Ada County Household Hazardous Materials Collection Facility	577-4736	Email: chad.schwend@pscnow.com
Chad Schwend - Hidden Hollow Landfill	869-4468 (cell)	Services: Accepts environmental waste including oil, antifreeze, paint, solvents, pesticides, and cleaning supplies. Up to 110 pounds/month.
L & R Environmental Land Farms	313-1276	E-Mail: 3131276@gmail.com
Ryan	243-2611	Disposal of contaminated soil.

Assisting Agencies

A variety of public agencies are available to assist with hazardous clean up, enforcement and emergency response.

Boise Public Works Department	384-3916	Terry Alber, Pretreatment Coordinator Services: Commercial and industrial billing and Stormwater complaint response.
Congestion Management Center	387-6198	Service: Controls traffic signals within Ada County and provides remote intersection monitoring at many of the main Ada County intersections. Can change timing of traffic signals or put the signals on four way flash during emergency situations.
Shawn Kimmell	860-6660	
Garden City Environmental Department	472-2900X116	
Kevin Wallis - Environmental Manager		
Meridian City Code Enforcement	941-9715	
Sargeant Matt Parsons		
State Comm	1800-632-8000	StateComm is the first agency notified by the 911 dispatcher when a hazardous spill has been reported. The StateComm Communications Moderator is tasked with setting up a bridge call with area experts and determining a course of action for spill containment, evacuation, and cleanup.
National Response Center	1800-424-8802	If spill is a CERCLA chemical
Ada County - Hidden Hollow Landfill	577-4725	Contact Ted Hutchinson to report garbage along Seaman's Gulch Road and Gary Lane. Dave will dispatch a crew to clean up the garbage.

Revised 6/13/16

APPENDIX D ILLICIT DISCHARGE FORM

ILLICIT DISCHARGE RESPONSE FORM

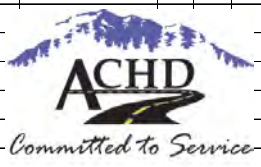
Form ID1a - Return to Luke Roberts (lproberts@achdidaho.org) 387-6264

Responder Information			
Report Taken By:		Report Date:	
Report Time:			
Contact Information:			
Incident Location:			
Street Address			
City			
Pollutant:			
Incident Description:			
Suspected Responsible Party (name, address, vehicle description, license plate# etc.)			
Name for Report:			
Other Info.:			
Summary of Action Taken for Report:			
Notes:			
Relative Quantity:			
Severity:	1		

1: Very low/negligible effects
2: Discharge occurred and possible damage to system
3: Discharge occurred cleanup is necessary
4: Significant discharge ongoing cleanup necessary
5: Very serious impairment to waterways

APPENDIX E DAMAGE CLAIM FORM

Damage Claim Form



Jim D. Hansen, President
Sara M. Baker, Vice President
Rebecca W. Arnold, Commissioner
Kent Goldthorpe, Commissioner
Paul Woods, Commissioner

Date:
Location:
Work Desc:

MATERIALS

Qty	Description	Unit Cost	Amount
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -

EQUIPMENT

Equipment #	Rate	Hours	Amount
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -

CONTRACT

Vendor Name		Amount
		$ -

LABOR

Employee Name	Rate	Hours	Amount
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -
			$ -

TOTALS

Labor	$ -
Equipment	$ -
Contract	$ -
Materials	$ -
Total Amount Due	$ -

Date prepared:
by Darla Young

APPENDIX F HOMELAND SECURITY FORM

IDAHO BUREAU OF HOMELAND SECURITY
EMERGENCY RESPONSE INCIDENT REPORT
STATE COMM NUMBER: _____

AGENCY SUBMITTING CLAIM:_____ INCIDENT DATE:_____

RESPONDING AGENCY (IES)
ADDRESS(S):_____

_____

COMPLETED BY:_____ PHONE #:_____

E-MAIL ADDRESS:_____

INCIDENT LOCATION:_____

CITY:_____ COUNTY:_____ ZIP:_____

GPS COORDINATES (If available):_____

TIME RESPONSE BEGAN:_____ ENDED:_____

INCIDENT COMMANDER:_____ AGENCY:_____

RESPONSE TEAM LEADER_____ RRT:_____

SOURCE/CAUSE OF RESPONSE:_____

_____

RESPONSIBLE PARTY/SUSPECT:_____

_____

CONTACT NAME:_____ TITLE: _____

MAILING ADDRESS:_____ CITY:_____ STATE:_____ ZIP:_____

TELEPHONE:_____ MESSAGE PHONE:_____

INSURANCE COMPANY:_____ AGENT:_____

ADDRESS:_____ CITY:_____ STATE:_____ ZIP:_____

TELEPHONE:_____ MESSAGE PHONE:_____

INCIDENT INFORMATION:

SUBSTANCE(S) INVOLVED:

SUMMARY OF RESPONSE ACTION:

ADDITIONAL INFORMATION

DOCUMENTATION ATTACHED:

PHOTOS: ☐ VIDEO: ☐ RECEIPTS: ☐ NARRATIVE/TIMELINE: ☐