CITY OF TUMWATER

Outfall Reconnaissance Inventory & Stream Assessment

City of Tumwater
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ACKNOWLEDGEMENTS

City of Tumwater

Outfall Reconnaissance Inventory and Stream Assessment

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Technical Memorandum

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Background and Purpose of Memorandum

The NPDES Phase II Permit (Permit) for Western Washington requires that the City of Tumwater (City) develop, implement, and enforce an ongoing program to detect and address non-stormwater discharges to the City's stormwater drainage system. The Permit also requires that the City prioritize receiving waters for visual inspection and conduct field assessment activities to verify known outfall locations, identify previously unknown outfalls, and detect illicit discharges. One of the main methods for detecting illicit discharges is to inspect outfalls to determine if dry-weather flows are occurring, or if evidence of prior illicit discharges is present.

URS Corporation (URS) was retained by the City to complete an Outfall Reconnaissance Inventory (ORI) along the Deschutes River, Percival Creek, and Black Lake Drainage Ditch within City limits. Additionally, the City requested that URS identify candidate sites along each stream for potential stream/riparian restoration projects that may enhance water quality.

The purpose of this Technical Memorandum is to summarize the process used to prepare for and carry out the ORI and stream assessment work, present the results and findings, and describe recommended follow-up work.

Field Work Planning and Preparations

URS and City staff identified a number of planning and coordination related issues that needed to be completed in advance of the scheduled ORI and stream assessment work, including:

- Public interface and private property access needs;
- Thurston County and City of Olympia system/jurisdiction interactions;
- Field work staff resource needs;
- Roles and responsibilities of field crew members;
- Staging and timing of field work;
- Pre-field work training for field crew members;
- Traffic control and safety;
- Field equipment;

- Documentation methods;
- Data recording and management;
- Potential follow-up tracing; and
- Resolution and correction of storm system mapping errors that may be discovered.

To address the above listed items, an approach was developed, which is described in Technical Memorandum #1—Outfall Reconnaissance Inventory (ORI) and Stream Assessment Field Work Planning Memo (URS, 2013) (Attachment 1).

Field Work Methodology

The ORI and stream assessment field work was conducted over a three day period beginning on May 14, 2013 and ending on May 16, 2013. URS staff assessed three streams: the Deschutes River, Percival Creek, and Black Lake Drainage Ditch within City limits. The purpose of the ORI and stream assessment work was to visually inspect known City outfalls and previously unknown outfalls for the presence of illicit discharges, document any errors in the City's existing storm system mapping, and identify potential stream restoration opportunities. The work was divided amongst two field crews as follows:

- Team 1 – Deschutes River Left Bank and Black Lake Drainage Ditch
- Team 2 – Deschutes River Right Bank and Percival Creek

ORI Documentation Methods

The following tasks were performed at each known and previously unknown outfall encountered:

- Assign unique outfall ID number;
- Photograph general vicinity of outfall;
- Document location of outfall on field map and/or GPS; and
- Complete Outfall Inspection Report Form.

A unique outfall ID number was assigned to each known and previously unknown outfall encountered using the following methodology:

> ***Unknown-Stream Name-Left or Right Bank-Encounter Number***
> (e.g., UNK-DR-LB-001)

Note: *Since the City's existing storm system mapping did not assign unique identifier numbers to the known outfalls, all outfalls encountered were assigned "unknown" identifier numbers.*

A series of photographs were taken at each outfall, including a close-up view as well as general vicinity images. Vicinity images generally consisted of bank, upstream, and downstream views of each outfall encountered. A catalog of photographs is provided on DVD #1.

Sketches/notes were recorded on the provided GIS Field Mapbooks (Attachment 2) and Outfall Inspection Report Forms (Attachment 4) detailing the location of previously unknown outfalls. Outfall locations from known reference points (e.g., bridge faces/abutments, adjacent outfalls) were

measured with wheel tapes or other measurement device and recorded on the provided field maps and forms. The field notes and measurements were later used to develop an outfall point file in GIS locating the previously unknown outfalls. In addition, field crews verified the location of known outfalls as they appeared on the field maps. If the known outfalls did not appear in the general location as shown on the field map, sketches/notes were made so that their spatial location could later be adjusted in GIS. Where possible, GPS was utilized to record the location of observed outfalls.

Field crews completed an Outfall Inspection Report Form (Attachment 4) for each known and previously unknown outfall encountered. If physical indicators of a potential illicit discharge were detectable from a flowing or non-flowing outfall, severity levels were assessed and tallied to determine the action level and recommended course of action and/or follow-up investigation work. If flowing water was present, flow measurements were estimated and recorded on the form. In addition, if flows were identified as a potential illicit concern, then water quality testing was performed and results recorded on the form.

Restoration Opportunity Documentation Methods

A simplified, site-specific method was used to assess stream conditions and identify several candidate sites for future restoration projects. Emphasis was placed on the identification of projects that could address water quality limiting factors documented in the Deschutes River Watershed Total Maximum Daily Load (TMDL). Water quality limiting factors for this watershed include: dissolved oxygen, fecal coliform, PCBs, pH, phosphorus, and temperature. A more detailed investigation of candidate sites may be necessary at a later date in order to fully assess stream conditions and/or gather the data necessary to properly design restoration projects.

The following tasks were performed at each of the restoration opportunity areas:

- Assign unique restoration opportunity ID number;
- Photograph the general vicinity of potential restoration site;
- Document location of site on field map and/or GPS; and
- Complete a Restoration Opportunity Field Form.

Restoration opportunity areas were identified in the field where discrete locations contained degraded shoreline or stream conditions that differed from surrounding, less-degraded areas. Ubiquitous impairments associated with the urban environment were not documented as a site-specific restoration opportunity, but were included in the overall description of the stream condition. Where a detrimental shoreline process or land use was resulting in a discrete area of shoreline or stream disturbance, URS recorded site-specific information for the area on the Restoration Opportunity Field Form (Attachment 5). Recorded information included dimensions and location of the site, impairment characteristics, and applicable restoration opportunities. If reference conditions were available nearby that could be used to target the restoration goals, URS briefly documented the area in relation to the restoration opportunity site.

Restoration opportunity areas were assigned a unique identifier number using the following methodology:

> ***Restoration Opportunity-Stream Name-Encounter Number***
> (e.g., RO-DR-001)

Post Field Work Activities

Field Forms and Photographs

Upon completion of the field work, all completed Outfall Inspection Report Forms and Restoration Opportunity Field Forms were scanned as PDF documents, cataloged by stream, and renamed using the following convention:

> ***Outfall ID***.pdf (e.g., UNK-DR-LB-001.pdf); or
> ***Restoration Opportunity ID***.pdf (e.g., RO-DR-001.pdf).

The scanned Outfall Inspection Report Forms and Restoration Opportunity Field Forms are included on the attached DVD #1. In addition, all hard copy field forms and GIS field maps are included as attachments to this Technical Memorandum.

All images were cataloged by stream and renamed using the following convention:

> ***Outfall ID_Image#***.jpg (e.g., UNK-DR-LB-001_1.jpg); or
> ***Restoration Opportunity ID_Image#***.jpg (e.g., RO-DR-001_1.jpg).

For convenience, each form and its associated images have been combined into single PDF document. In addition, the combined PDF documents have been hyperlinked within GIS to their corresponding spatial data point and are included on the attached DVD #2.

Field Form Summary Spreadsheet

The completed Outfall Inspection Report Forms were used to create a Field Form Summary spreadsheet for all outfalls encountered. Information provided for each outfall included: inspection date; stream; stream bank; outfall ID; outfall type; pipe material, shape, configuration, diameter/dimensions for closed pipes; ditch dimensions for open channels; presence of flow; potential illicit concern; physical indicator score; action level based on summation of severity indices; general notes; and notes for recommended repair/maintenance activities. The Excel-based ORI Data Summary Spreadsheet is included as Attachment 3 and on the attached DVDs #1 and #2.

The spreadsheet allows users to review and query outfall-specific information and identify outfalls that will require follow-up investigation activities based on observed physical indicators and action level ratings. In addition, the spreadsheet can be joined to the outfall GIS file to run similar analyses within an ArcGIS environment, as discussed below.

Updated GIS Files

Three new GIS files and associated mapping products were developed to summarize the results of the ORI and stream assessment field work. The GIS files are included on the attached DVD #2.

The first file, ***URS_Points_ORI_2013***, is a GIS point file displaying the spatial location of all outfalls investigated, as well as other storm infrastructure, and ordinary high water line. The GIS point file contains the following attribute fields:

- **Type** – Identifies whether the point represents an outfall, ordinary high water line, or other stormwater infrastructure.
- **Stream_Name** – Stream name where outfall is located.
- **Outfall_ID** – Identification number assigned to known/previously unknown outfall.
- **Comment** – Comment recorded in field further describing the point.
- **Collection_Method** – Identifies the collection method (Handheld GPS or Placed on Map).
- **Field_Form** – File path locations used to hyperlink to the combined field forms and imagery.

Recall that the spatial location of all known City outfalls were field verified and adjusted, as necessary, based on review of the GIS field maps and measurements made in the field, while the spatial location for all previously unknown outfalls was derived from GPS or field measurements taken from known reference points along each stream. Figures 1 – 3 show the stream reaches investigated along with updated outfall spatial data for the Deschutes River, Percival Creek, and Black Lake Drainage Ditch, respectively.

GIS mapping symbols have been used in Figures 1 – 3 to distinguish outfalls based on the severity of water quality concern with respect to illicit discharges (i.e., action level). Of the outfalls investigated, all were categorized as having No Suspected Illicit Discharge; therefore, only a single mapping symbol was required to depict the outfalls assessed (i.e., green symbol in Figures 1 – 3). Known outfalls not physically located and formally assessed are displayed as a red colored symbol in Figures 1 – 3; these outfalls will require follow-up work as described in the *Recommended Follow-up Work* section.

As mentioned above, the combined PDF documents (field form and imagery) have been hyperlinked within GIS to their corresponding spatial data point. This allows users within GIS easy access to outfall specific information. For a particular outfall of interest, users can simply click on the outfall symbol to access the field form and associated images.

The Field Form Summary spreadsheet and the attribute table associated with the point file ***URS_Points_ORI_2013*** may be joined within GIS based on outfall ID, which is a common field to both tables. Joining these two tables within GIS expands the number of attribute fields and information available (e.g., pipe size and material, action level) for each outfall location.

The second file, ***URS_Lines_ORI_2013***, is a GIS line file containing updated stream delineations based on field observations; in certain locations, the existing stream delineations were found to be incorrect. These updated stream delineations may be used to update the City's GIS data. Also included in the GIS line file are flow paths for specific outfalls, as well as stream bank and centerline information for limited locations.

The third file, ***URS_Polygons_ORI_2013***, is a GIS polygon file displaying the location and extent of stream restoration opportunity areas. The GIS polygon file contains the following attribute fields:

- **Stream_Name** – Stream name where restoration opportunity is located.
- **Restoration_Opportunity_ID** – Identification number assigned to restoration opportunity area.
- **Field_Form** – File path locations used to hyperlink to the combined field forms and imagery.

Summary of Findings

The following discussion highlights the major findings from the ORI and stream assessment work conducted on the Deschutes River, Percival Creek, and Black Lake Drainage Ditch over a three day period beginning on May 14, 2013 and ending on May 16, 2013.

- URS investigated a total of 60 outfalls during the course of the field work, of which 55 were previously unknown. Table 1 summarizes the number of outfalls investigated by stream.

Table 1
Outfalls Investigated by Stream

Stream Name	Total Previously Unknown Outfalls	Total Outfalls Investigated
Deschutes River	49	51
Percival Creek	5	7
Black Lake Drainage Ditch	1	2
Total	***55***	***60***

- Four of the previously mapped outfalls were not formally assessed because they could not be physically located. City staff should attempt to locate these outfalls before any future mapping of the stormwater drainage system is completed.
- A total of 15 outfalls encountered had flowing water. The number of outfalls with flowing water by stream included: Deschutes River (14); Percival Creek (0); and Black Lake Drainage Ditch (1). The flowing outfalls generally appeared to be of wetland or groundwater origin and do not represent an illicit discharge concern for the City; therefore, no water quality testing was performed.
- Of the outfalls investigated, all were categorized as having No Suspected Illicit Discharge; therefore, no further action required by the City.
- URS identified six restoration opportunities along the Deschutes River and three restoration opportunities along Percival Creek. Table 2 summarizes the restoration opportunities by stream.

Table 2
Summary of Restoration Opportunities by Stream

Stream Name	Restoration Opportunity ID	Ecological Impairment	Proposed Restoration
Deschutes River	RO-DR-001	300-ft long area of active bank erosion and lack of native woody cover	• In-stream wood to divert/dissipate scour flows along right bank • Lay back/grade streambanks • Plant native woody trees & shrubs for shade and bank stability
Deschutes River	RO-DR-002	500-ft long area having overly steep streambanks that lack woody vegetation along upper terrace	• Plant native woody trees & shrubs for shade and bank stability (will help protect nearby golf fairway from potential losses due to erosion)
Deschutes River	RO-DR-003	Lack of vegetation/shade near bridge at golf course	• Plant native woody trees & shrubs for shade and bank stability
Deschutes River	RO-DR-004	Lack of vegetation/shade near bridge by golf course club house	• Plant native woody trees & shrubs for shade and bank stability
Deschutes River	RO-DR-005	Small area of eroding, vertical streambanks near parking lot for golf course lacking woody vegetation	• Lay back/grade streambanks • Plant native woody trees & shrubs for shade and bank stability • Place in-stream features at base of slope to provide energy dissipation
Deschutes River	RO-DR-006	Long, narrow flood terrace below developed area dominated by reed canarygrass with little shade provided	• Plant native woody trees & shrubs for shade and bank stability

Table 2 (cont.) Summary of Restoration Opportunities by Stream			
Stream Name	**Restoration Opportunity ID**	**Ecological Impairment**	**Proposed Restoration**
Percival Creek	RO-PC-001	Portion of creek that is mowed and landscaped	• Plant native woody trees & shrubs for shade and bank stability
Percival Creek	RO-PC-002	Large wetland floodplain around creek on public lands dominated by reed canarygrass	• Control reed canarygrass by chemical or mechanical means and replace with diverse native vegetation • Add in-stream wood to increase in-stream fish habitat complexity, floodplain connectivity, and associated sediment retention • Plant native woody trees & shrubs for shade and bank stability
Percival Creek	RO-PC-003	Portion of creek that is mowed and landscaped	• Plant native woody trees & shrubs for shade and bank stability

- Restoration opportunities along the Deschutes River included areas having active erosion concerns and/or areas lacking riparian cover. In addition to improved water quality associated with loose sediment stabilization and thermoregulation, the proposed plantings would provide a more continuous corridor of vegetation cover for wildlife that migrate along the river.
- Some of the restoration opportunities along the Deschutes River have the potential to erode into the City's golf course if not addressed.
- The majority of Black Lack Ditch could also be seen as one large opportunity for replacing reed canarygrass (a noxious wetland grass) with native, shade-producing woody shrub vegetation.
- Restoration opportunities noted on private properties, including RO-PC-001 and 003, are small in area and, therefore, low priority. However, it is worth reaching out to the landowners to see if they have interest in minimizing their routine mowing along the edge of the streambank and/or native shrub landscaping to improve streambank stability and habitat conditions.
- The restoration areas summarized in Table 2 are shown in Figures 4 – 12. As noted above, the Restoration Opportunity Field Forms are provided in Attachment 5, and the restoration area polygon GIS data is included with DVD #2, where it can be viewed and queried in an Arc GIS environment.

Recommended Follow-up Work

As stated previously, all of the outfalls investigated were categorized as having No Suspected Illicit Discharge; however, a number of known City outfalls were not formally assessed as part of this study because they could not be located. In cases where outfalls could not be physically located, field crews generally encountered excessive vegetation growth that concealed the location of outfalls. As such, City field maintenance crews should visit these locations and attempt to locate the outfalls by one or more techniques, including excavation equipment, jet rodding, smoke testing, use of a metal detector, or other means. Once located, City staff will need to formally inspect and assess each outfall for the presence of illicit discharges following the methodology described above, as well as update all project-related products (combined field form and associated imagery, PDF files, GIS hyperlinks, Field Form Summary spreadsheet, etc.).

The City should utilize the provided GIS files to update their storm drainage system mapping. Updates may include: spatially adjusting known outfall locations, adding previously unknown outfalls, updating storm pipe segments, and updating stream segment alignments.

Proposed restoration opportunities noted in this study are recommended to provide enhanced water quality and habitat for native fish and wildlife. Of particular concern are the areas of severe bank erosion along the Deschutes River (RO-DR-001 and 005). These areas contain unstable bank sediments that can create turbid water conditions during periods of moderate to high flows. Also, these areas have the potential for additional bank failure, which can infringe upon existing City infrastructure associated with the golf course. It is recommended that the City review these restoration opportunities and prioritize them based on bank vulnerability and public land ownership. The City may then prepare grant applications to develop plans and specifications for bank stabilization and habitat enhancement projects.